SESSIONAL PAPERS

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OF THE

FOURTEENTH LEGISLATURE

OF THE

PROVINCE OF ONTARIO

SESSION 1915

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No. 64 Return to an Order of the House of the 10th March, 1915, for a Return showing:—1. Copies of all petitions or requests received by the Government since the 1st day of January, 1914, from any Municipal Authority or Body in the Province in reference to the imposition of a tax upon automobiles, or as to the distribution of that tax or a portion thereof to the municipalities maintaining the roads. 2. Copies of all correspondence between the Government and any officer or official thereof and any Municipality of the Province, or any Automobile Association or Organization in reference to the said matter. Presented to the Legislature, March 17th, 1915. Mr. *Racine. Not Printed.*

No. 65 Return to an Address to His Honour the Lieutenant-Governor of the 11th March, 1915, for a Return of:—1. Copies of all Orders-in-Council and correspondence between the Government and any officer or official thereof and the Timiskaming and Northern Ontario Railway Company and any officer or official thereof in reference to the retirement of Frederick Dane as one of the Commissioners of the said Railway. 2. Copies of all Orders-in-Council and correspondence between the Government and

any officer or official thereof and the Timiskaming and Northern Ontario Railway Company with reference to the appointment of Mr. Lee as one of the Commissioners of the said Railway. Presented to the Legislature, March 19th, 1915. Mr. *Mageau. Not Printed.*

No. 66 Return to an Order of the House of the 15th March, 1915, for a Return showing:—1. What officers have been appointed by the Workmen's Compensation Board under section 59 of the Workmen's Compensation Act. 2. What are the names, dates of appointment, and salaries of each officer so appointed. Presented to the Legislature, March 18th, 1915. Mr. *Carter. Not Printed.*

No. 67 Return to an Order of the House of 3rd March, 1915, for a Return showing:—1. All statements furnished by the Canada Copper Company, the International Nickel Company, the Mond Nickel Company and any other companies producing nickel, under section 8 of the Mining Tax Act respecting Taxation. 2. All reports from any Government mining assessor, made under the provisions of the Mining Taxation Act in respect of the mining operations of the Canada Copper Company, the International Nickel Company or the Mond Nickel Company, and particularly with reference to the royalties or taxes to be paid by the said Companies. 3. All correspondence between the Minister of Lands, Forests and Mines, or the Provincial Treasurer, or any officer or official of the Government and the Canada Copper Company, the International Nickel Company, the Mond Nickel Company and any other Companies producing nickel, with reference to the amount of royalties or taxes paid by the said Companies, or any of them, to the Provincial Treasury of the Province in respect of the ore mined or the mining operations carried on by them in the Province of Ontario. Presented to the Legislature, March 18th, 1915. Mr. *Carter. Not Printed.*

No. 68 Proceedings of the Second Annual Convention of the Association of Cemetery Officials of Canada. Presented to the Legislature, March 26th, 1915. *Not Printed.*

No. 69 Return to an Address of the 23rd day of March, 1915, praying for a Return shewing: 1. Copy of Order-in-Council dated 14th day of February, 1871, appropriating and transferring to the Government of the Province of Ontario the lands and property known as The Ontario Government House. 2. Copy of the Letters Patent dated the 15th day of January, 1908, declaring the said lands to have been transferred and appropriated for the use of the Provincial Legislature of the Province of Ontario within the meaning of the British North America Act, 1867. Presented to the Legislature 26th March, 1915. Mr. *Bowman. Not Printed.*

No. 70 Return to an Order of the House of the 25th March, 1915, for a Return showing:—1. How many convictions for violation of the Liquor License Law have been made for the electoral district for North Essex since the re-appointment of Paul Morand as License Inspector at the end of May, 1914. 2. Have Provincial officers or detectives been sent into this district since the 1st of June, 1914, to assist in securing enforcement of the law. 3. How many prosecutions have been instituted by, or at the instance of Provincial officers or detectives, and the said Paul Morand, respectively. Presented to the Legislature, March 29th, 1915. Mr. *Richardson*. *Not Printed.*

No. 71 Special Report on the Organization and Administration of the Hospitals for the Insane, Feeble-Minded and Epileptics and District Industrial Farms of the Province. Presented to the Legislature, March 29th, 1915. *Printed for distribution only.*

No. 72 Return to an Order of the House of the 24th March, 1915, for a Return showing:—1. What is the total number of the herd for dairy purposes now maintained by the Government at the Guelph Prison Farm. 2. How many of these were purchased and how many raised on the farm, respectively. 3. What was the total amount paid by the Government for the portion of the herd purchased by them. Presented to the Legislature, 31st March, 1915. Mr. *Ham*. *Not Printed.*

No. 73 Financial Statement of the Treasurer of Ontario. Presented to the Legislature, April 2nd, 1915. *Printed for distribution only.*

No. 74 Return to an Order of the House of 31st March, 1915, for a Return showing:—1. The number of English-French schools which have complied in the year 1914 with Regulation 17 of the Department of Education passed in the year 1913. 2. The number of English-French schools which have not complied with said Regulation 17 in the year 1914. 3. What English-French schools have received grants in the year 1914 under the Public Schools Act, and the amount thereof. 4. Copy of joint reports, if any, made by any inspectors pursuant to Regulation 17 and dated on or about May 23rd, 1913. 5. Copy of letters exchanged between ex-Inspector Henri Saint Jacques and the Department of Education or any officer or officers thereof with reference to the resignation of the said Henri Saint Jacques which are dated on or about the 18th October, 1913, and the 23rd October, 1913. Presented to the Legislature, April 2nd, 1915. Mr. *Mageau*. *Not Printed.*

No. 75 Return to an Order of the House of the 17th March, 1915, for a Return showing:—1. How many timber berths or locations have been sold since the 1st day of January, 1914. 2. Were all such berths or locations advertised for sale; if not, which ones were sold without advertisement. 3. If any were sold without

being advertised for sale, who were the purchasers, and what are the prices realized and the dates of the sales, respectively. 4. In what papers were the different timber berths or locations respectively advertised for sale, and what were the dates of such advertisements respectively. 5. What is the period for which they were so advertised in the said papers, respectively. Presented to the Legislature, April 2nd, 1915. Mr. *Munro. Not Printed.*

No. 76 Telephone Systems, specifications, etc., as *per* Report of Ontario Railway and Municipal Board. Presented to the Legislature, April 2nd, 1915. *Printed.*

No. 77 Return to an Order of the House of the 28th April, 1914, for a Return showing:—1. If the Government granted the right to cut Pine or any other timber to Messrs. Foley Bros., Contractors, or to the Northern Construction Company, Limited, or to any person, firm or company in connection with the construction of the Canadian Northern Railway Company in the vicinity of Duchesne Lake, situate about 90 miles from the Town of Sudbury. 2. If so, to what persons, firms or companies were such permits made, and the dates of each. 3. What consideration did the Government receive with respect to each of the said permits, if any. 4. What Pine or other timber has been cut to date by each of the persons, firms or companies with respect to such permits. 5. How long was the right to cut to last and over what extent of land; and what were the other terms or conditions upon which such permits were made, if any. 6. What was the date of the completion of the construction of the Canadian Northern Railway at this point. 7. What amount of timber has been cut by any person, firm or company to whom such permit, as mentioned, has been made. 8. Is any person, firm or company at the present time cutting timber pursuant to such permit. Presented to the Legislature, April 2nd, 1915. Mr. *Richardson. Not Printed.*

No. 78 Return to an Order of the House of the 27th March, 1914, for a Return of:—All correspondence with reference to the resignation of Mr. Harkness, Manager, Superintendent of the Jordan Experimental Station. 2. The reports of the Committee or Advisory Board of the said farm for the years 1911, 1912 and 1913. 3. Statements showing the total expenditure to date divided between cost of building, cost of land, improvements of land and cost of management. Presented to the Legislature, April 2nd, 1915. Mr. *Anderson (Bruce.) Not Printed.*

No. 79 Return to an Order of the House of the 7th April, 1914, for a Return showing:—1. If the Lieutenant-Governor in Council made any arrangements under section 9 of the Succession Duties Act, with any part of the British Dominions, or with any

foreign country; and if so, with what Provinces or countries. 2. If no such arrangement has been made with the Province of Quebec, does the Honourable the Provincial Treasurer make an allowance with respect to Succession Duties in Ontario with respect to shares of stock of a bank or other financial institution whose head office is in the Province of Quebec. 3. If it is true that a Succession Duty is payable with respect to such shares, both in Quebec and Ontario, will legislation be introduced to protect estates from payment of double duty. Presented to the Legislature, April 2nd, 1915. Mr. *Marshall. Not Printed.*

No. 80 Return to an Order of the House of the 27th April, 1914, for a Return showing:—1. What consideration was paid by the licensee to the Government in respect of the issue of the original licenses respectively, of the territory included within the proposed agreement with the Pembroke Lumber Company. 2. How much was paid by the Pembroke Lumber Company for these licenses respectively at the date of the purchase thereof by them. 3. What amounts of pine, hemlock, cedar, spruce, hardwood and other timber respectively have been cut on the limits or areas covered by the proposed agreement and returned to the Department as so cut by the Pembroke Lumber Company in each of the years since the purchase thereof by them. Presented to the Legislature, April 2nd, 1915. Mr. *Bowman. Not Printed.*

No. 81 Statement on the distribution of the Revised and Sessional Statutes, up to 31st December, 1914. Presented to the Legislature, April 2nd, 1915. *Not Printed.*

REPORT

OF THE

Minister of Lands, Forests and Mines

OF THE

PROVINCE OF ONTARIO

For the Year Ending 31st October

1914

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

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Report of the Minister of Lands, Forests and Mines of the Province of Ontario

For the Year Ending 31st October, 1914

To His Honour The Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

I have the honour to submit for the information of your Honour and the Legislative Assembly a report for the fiscal year ending 31st October, 1914, of the management of the Crown Lands of the Province.

Clergy Lands.

The area sold during the year was 447 acres, the value of which was $256.50. The collection on account of Clergy Lands was $1,367.56. (See Appendix No. 3, page 7.)

Common School Lands.

There were no sales. The collection on account of former sales was $4,978.03. (See Appendix No. 3, page 7.)

Grammar School Lands.

The area sold during the year was 25 acres, for $43.75. The collection on account of those and former sales was $957.91. (See Appendix No. 3, page 7.)

University Lands.

The area of these lands sold during the year was 6,047 acres for $3,023.50. The collection on account of these and former sales was $2,498.74. (See Appendix No. 3, page 7.)

Crown Lands.

There was sold during the year for agricultural and town site areas 137,666 acres for $98,030.68. The collection on account of these and former sales was $83,529.50. There was sold for mining purposes 17,383 acres for $43,763.31. There was collected on account of these and former sales $41,027.50.

There was leased for mining purposes 5,837 acres for $5,837.61. There was collected on account of these leases and those of former years $16,469.76. There was leased of Crown lands an area of 7,555 acres for $5,749.06. There was collected on account of these and the leases of former years $40,755.48.

The total area of Crown lands disposed of by sale and lease during the year was 174,961 acres for a value of $156,704.41, as compared with 260,873 acres sold and leased in 1913 for $259,956.88. The total collection on account of the sales, leases, etc., was $191,584.48. (See Appendix No. 3, page 7.)

It will be observed that there has been a falling off in the number of sales made as well as in the receipts of money from that source. The net decrease in the number of purchases is 363. The causes of the falling off are not difficult to understand. They are attributable to the disturbance in all channels of trade, labor and finance. People found it very difficult to get money for any purpose and with the fear of what might occur those who had a few hundred dollars ahead preferred to keep them rather than to expend them in moving to a new part of the Province while matters were so unsettled. Then a considerable percentage of the young men that might have gone into newer parts have gone to fight for their King. In these and other ways it is quite easy to account for the falling off in the number of settlers who have taken up land in the newer parts of the Province. The falling off is mostly in the clay belt in Townships which have been opened for some little time. When a Township is opened for the first time there is a considerable rush of people into it which falls off when settlers have to go farther back from the railway and other highways. The Transcontinental Railway is still in the hands of the contractors.

Free Grants.

During the year, 1,882 persons were located for Free Grant Lands, or over 300 in excess of the previous year while 301 settlers purchased land in Free Grant territory, thereby making practically 2,200 persons taking possession of Free Grant land for a total area of 268,238 acres, which is greater by 28,966 acres than the year ending October 31st, 1913.

The northern portions of the Province benefited mostly by the settlement, the District of Thunder Bay receiving no less than 632 settlers, while Rainy River and Kenora received 761. The District of Sudbury and that portion of Nipissing lying north of Lake Nipissing, showed an increase over the preceding year. Patents were issued to 767 locatees who completed their settlement duties.

The Townships of Sterling in the District of Thunder Bay and of Britton and Rowell in Kenora were opened for location under the Free Grant Section of the Public Lands Act.

Military Grants.

The total number of military certificates issued to date, under the Veterans Land Grant Act, I Edward VII, Cap. 6, and amendments thereto, is 13,998.

During the year there have been 47 certificates located, making in all a total of 8,064 located.

There were 8 certificates surrendered to the Crown for the $50.00 commutation; this makes a total of 3,234 certificates surrendered.

In 19 cases the certificates have been surrendered and applied in payment of lands purchased from the Crown making a total of 721 that have been applied in this manner.

During the year there have been 335 patents issued for lands located by veterans making a total of 6,740 thus disposed of.

The total number, therefore, of certificates that have now been redeemed is 11,945, leaving 1,879 still outstanding.

The locatees of all lands granted under this Act, must apply for their patents for such land before ten years have expired from date of location. If this applica-

tion for patent is not made within the ten years, then the land comes under the settlement regulations, and unless the settlement duties are proceeded with, the locations are liable to cancellation.

The Mineral Industry.

The growth which marked the output of the mining industry of Ontario during the previous decade underwent a decided check in 1914, the value of the production being $46,632,105, as compared with $53,232,311 in 1913—a decrease of $6,600,206, or 12.3 per cent. It fell below the level of 1912 by $1,641,406, but considerably exceeded that of any preceding year. The decrease was somewhat greater in amount in the metallic than in the non-metallic products, being $3,638,438, as compared with $2,961,768.

The causes of this diminution were two: (1) the general depression in business which became apparent early in the year, and (2) the outbreak of hostilities in Europe.

Of gold the production was the largest in the history of the Province, 268,942 ounces, worth $5,529,767. Much the greater part came from Porcupine, the Hollinger mine being the leading producer. The Dome. Porcupine Crown and McIntyre Porcupine mines also contributed largely. There were in all 608,200 tons of ore crushed, the average yield being $9.14 per ton.

The output of silver in 1914 was 25,999,374 fine ounces, being a decrease, as compared with 1913, of 3,725,557 ounces, or 12.5 per cent., or 17.4 per cent. as compared with 1911, when the Cobalt mines were at their maximum and produced 31,507,791 ounces.

The return to the mining companies was $13,209,726. an average of 50.807 cents per ounce.

The production by camps was as follows:—

	Ounces.	Value.
Cobalt proper	24,940,613	$12,678,181
Casey township	499,643	236,298
South Lorrain	104,665	54,310
Gowganda	399,300	211,184
	25,944,221	$13,179,973
Silver recovered from auriferous ores	55,153	29,753
Total	25,999,374	$13,209,726

Since the opening of the mines at Cobalt the production of silver has amounted to over 211 million ounces, having a value of more than 111 million dollars.

Nickel was produced to the extent of 22,760 tons. and copper 14,453 tons. The source of these metals was the nickel-copper ore of the Sudbury District, of which there was raised 1,072,207 tons and smelted 947,053 tons. Some 79,825 tons of similar ore came from the Alexo mine in Dundonald township. The nickel contents of the matte were less than 1913 by 2,178 tons, and the copper contents more by 1,512 tons.

Iron ore, including concentrates, was shipped from the mines and works to the extent of 240,059 tons, valued at $531,379.

The production of pig iron fell from 648,899 tons worth $8,719,892 in 1913 to 556,112 tons worth $7,041,079 in 1914. Four blast furnace plants were in operation, namely, at Sault Ste. Marie, Hamilton. Port Colborne and Deseronto.

Building materials of all kinds had a diminished output, including brick, stone, lime, Portland cement, etc. Natural gas remained at practically the same figure as in 1913, while petroleum showed a continuation of the decline which set in a number of years ago.

Collections.

The total revenue of the Department from all sources was $2,340,657.07. Of this $83,529.50 came from agricultural lands and town sites; mining lands $41,027,-50; mining and crown leases $57,225.24; miners' licenses, permits and recording fees $64,195.26; royalties $74,685.11; supplementary revenue tax $306,861.40. From woods and forests the revenue was $1,674,887.93, made up of the following items, bonus $454,167.24; timber dues $1,112,480.38; ground rent $103,910.31; transfer fees $4,330.00. (See Appendix No. 4, page 8.)

Disbursements.

The total expenditure of the Department for ordinary services was $596,669.32. Some of the principal items were: Agents' salaries and disbursements $16,885.77; homestead inspectors $11,911.29; Crown timber agents $30,826.48; wood ranging and estimation of timber $118,462.80; fire ranging $150,588.05; forest reserves, fire ranging, etc., Temagami reserve $42,137.90, Metagami reserve $8,127.82, Mississaga reserve $20,066.19, Nipigon reserve $13,234.90, Eastern reserve $2,828.85, Sibley reserve $705.00; mines and mining $44,153.50; mining recorders $23,143.17; surveys $36,496.20; refunds $16,033.98; contingencies, lands and forests $33,448.48, bureau of mines $6,016.29.

There was expended under the direction of the Department the sum of $879,780.85. Of this amount, $802,578.19 was in connection with the northern development, under 2 Geo. V, while the other principal items were Algonquin Park $24,782.76, Quetico Provincial Park $11,003.18, and expenditure under Bounty Act, 7 Edward VII, cap. 14, $41,016.72. (See Appendix Nos. 6 and 7, pages 10 to 36.)

Woods and Forests.

The revenue accrued due for the year ending 31st October, 1914, was $2,009,-131.43, a decrease of $118,191.13, as compared with the accrual of last year. The revenue collected during the year from woods and forests amounted to $1,674,887.93, a decrease of $304,237.88 as compared with the revenue collected last year. The revenue from timber dues was $1,112,480.38 against a collection of $1,277,490.08 last year. The collection on account of Bonus was $454,167.24 as against $591,-676.29 last year. The collection on account of ground was $103,910.31 as against $99,460.19 of last year. The revenue from transfer fees was $4,330.00 as against $10,500.00 last year.

Lands Under License.

The area under license last year was 17,333 square miles, as against 17,517½ square miles last year. The area under license varies from year to year from several reasons. Areas cut-over are dropped and other areas go into what is called "abeyance," that is the ground rent not being paid the license does not

issue, or perhaps Crown timber dues are owing, in which case the license does not issue. Then the next year the ground rent or dues having been paid up the licenses are again issued and the area under license is considerably increased although no sale has taken place.

There was surrendered during the year 1,111 square miles and new licenses were issued for territory aggregating nearly 500 square miles.

Volume of Output.

The production of pine timber, sawlogs and square timber, etc., in feet board measure during the year was 382,582,027 ft. B.M., being 22,204,839 ft. B.M. in excess of the output of last year. The output of timber other than pine this year was 77,451,857 ft. B.M. as against 64,097,436 ft. B.M. last year. The quantity of pulpwood taken off Crown Lands was 104,544 cords as against 131,434 cords last year. There were taken out 5,439,845 pieces of railway ties as against 6,355,828 pieces last year.

Financial Stringency.

In the report last year the existence of financial stringency was referred to and the opinion was expressed that there would not be much increase in the output of logs. Financial matters did not improve, but on the contrary became worse in the sense that the war came upon us in August just when lumbermen were making arrangements for the payment of accounts for the previous season and also for advances on account of their lumber operations during the coming season. For some time after the breaking out of the war financial matters were in a state of chaos and lumbermen found it impossible to finance both their operations and the payment of their accounts for timber dues and they frankly said so. The Department has never failed to take into consideration the state of financial matters and to assist in preventing a crisis in the lumber trade by extending leniency to those indebted to it for timber dues, because the security of the limits is good. In pursuance of that policy the Department did not press for payment in full of accounts for dues, etc., consequently the collection from woods and forests has been about $304,237.88 below the estimated revenue. It is not expected that the output for the present winter will greatly exceed that of last winter, although the financial position is somewhat improved.

Fire-ranging.

We had on duty last year directly under the supervision of the Department 606 men, distributed as follows: On forest reserves 214; Quetico and Algonquin Parks 19; railways 229; Crown lands 106; chief rangers 26; deputy chief rangers 4; supervising rangers on licensed territory 8. On lands under license there were 320 rangers on duty. These rangers are selected by the licensees, subject to the approval of the Department which has power to refuse to appoint or remove after appointment if the person recommended is not of good character or neglects his duties. The recommendations are left with the licensees because they have their lumbermen, foremen and others who are familiar with the topography of their limits and know where settlers are and generally the danger points which require close watching. The licensees have to pay their own rangers and any expense caused by the fighting of forest fires on their limits. The Department puts on supervising rangers—8 in number—on the licensed territory for the purpose of

seeing that the lumberers' rangers are on duty and that all limits are properly protected. If the licensees neglect to put on the necessary rangers the Department puts them on and charges the remuneration and expense against the limit, withholding the license until the indebtedness is paid. The supervising rangers —8 in number—are paid by the Department in the first place, but the expense and wages are collected from the licensees pro rata, according to the miles under license to each.

Several fires occurred last year. A few in the Mississaga Forest Reserve, which necessitated the sale of some timber berths in order that the timber should be cut during the present season. There was also a serious fire in the Algonquin Park which was extinguished with difficulty and not until considerable timber was damaged. This timber was offered for sale but owing to the depression in the timber trade no bids were obtained. On the whole, however, the fires on lands of the Crown were not serious and except as above stated, no losses were incurred. There were several fires on licensed territory, notably in the Townships of Parkin, Goschen and Montgomery. In all these cases the licensees made preparations to cut the damaged timber and it will not come out this winter. The Georgian Bay Lumber Company lost their camps and supplies. Altogether, their loss of $10,000.00 was entailed by the carelessness of someone.

Forest Reserves.

Temagami forest reserve contains an area of 6,000 miles. It has had the usual staff of firerangers in it during the past year and no fires have taken place.

Mississaga forest reserve is tributary to a river of the same name. The original area of this reserve was 3,000 miles, but last year there was added to it 1,896 miles, so that it now contains an area of 4,896 miles. One or two fires occurred in the reserve during the past year, which are referred to under the heading of fireranging.

Nipigon forest reserve contains an area of 7,300 miles. It surrounds Lake Nipigon, a large lake. While it does not contain a great quantity of pine there is considerable pine in it and an enormous quantity of pulp timber, spruce, etc. There were no fires in this reserve during the past year.

What was called the Quetico reserve in Rainy Lake District contains an area of 1,500 miles, and has a large quantity of pine timber in it. It is now changed into a park, and is known as the Quetico Provincial Park.

The Eastern forest reserve is situated in the County of Addington and has an area of 100 square miles. There were no fires in this reserve during the past year.

Sibley reserve contains an area of 70 miles and is preserved principally to keep the promontory called "Thunder Cape" covered with timber. There were no fires in this reserve during the past year.

Algonquin National Park contains an area of 2,741 square miles. There was one serious fire in it during the past summer.

Railways.

There was a staff of firerangers on the Transcontinental, the T. & N. O., the Canadian Northern and the Algoma Central. No serious fires occurred except in the Algonquin Park already referred to, and greater care is being exercised from year to year to prevent the spread of forest fires from railways.

The Department endeavored to obtain this year the percentage of fires that took place—small and great—the number that were suppressed by rangers and the causes of the fires. Our reports indicate that altogether there were 2,296 fires occurred during the season. Of this number 2,266 did no damage to timber. Of the total number 2,181 were reported by rangers patrolling railway lines—nearly all the fires being extinguished before they had a chance to spread. Of the causes of the fires 69 per cent. is ascribed to railway engines and railways; 7 per cent. to settlers; 7 per cent. to campers, hunters, fishers and careless smokers, and 17 per cent. to causes which were not ascertained.

There was from one million and a half to two million feet of pine damaged, together with considerable quantities of young pine, birch, spruce and basswood.

On the lands under license, 91 fires were reported: 69 per cent. of which did little or no damage. Ten per cent. of these were said to be caused by railways; 30 per cent. by settlers; 26 per cent. cause unknown, and there were a number of individual fires caused by fishers, section men, careless smokers and others. Only 15 or 20 fires went over areas exceeding 10 acres.

The cost of patrol of forest reserves was $84,148.59; on railways and Crown lands $148,079.28. The cost of extinguishing fires in forest reserves was $2,952.07; on railways and Crown lands $2,508.77. There are, as already stated, 325 rangers on licensed lands, the estimated cost of which would be approximately $85,000.

Cullers' Examinations.

Only one cullers' examination was held during the past year, viz., at North Bay. Only seven candidates were successful at this examination, and these were duly granted certificates authorizing them to act as cullers.

(For a list of cullers who passed at this examination see Appendix 35, page 85.)

(For a complete list of licensed cullers see Minister's reports for 1911, 1912 and 1913.)

Crown Surveys.

The following Crown Surveys have been concluded this year:

Township outlines in the Districts of Algoma and Sudbury.
Township of Scholfield, in the District of Algoma.
Township of Lowther, in the District of Algoma.
Township of Caithness, in the District of Algoma.
Township of Orkney, in the District of Algoma.
Township of Ebbs, in the District of Algoma.
Township of Shetland, in the District of Algoma.
Township of Talbot, in the District of Algoma.
Township of O'Brien, in the District of Timiskaming.
Part of the Township of Mattawan, District of Nipissing.
Township of Stirling, in the District of Thunder Bay.
Part of the Township of Ware, District of Thunder Bay.
Part of the Township of Gorham, District of Thunder Bay.
Township of Drayton, District of Kenora.
Township outlines, District of Kenora.
Township of Malachi, District of Kenora.
Township outlines, District of Kenora.

Instructions were Given for the Following Surveys.

Timber berths in the District of Kenora.

Township of Redvers, District of Kenora.

Part of the Township of Fraleigh, District of Thunder Bay.

Township of Upsala, District of Thunder Bay.

Survey in the Township of Beaumont, District of Sudbury.

Survey in the Mississaga forest reserve, District of Algoma.

Verification survey in the Township of Matchedash in the County of Simcoe, and Baxter and Wood, District of Muskoka.

Reports of the surveys so far as received and examined will be found in appendices 16 to 34 inclusive, pages 48 to 85.

Municipal Surveys.

On the petition of the Municipal Council of the Town of Oakville, instructions were issued to survey the boundaries or limits of certain parts of the following public highways in the Town of Oakville, namely, Dundas Street from the north-west limit of Sumner Street to the south-easterly limit of the right of way lands of the Grand Trunk Railway Company, and the "6th line road" from the westerly limit of Dundas Street aforesaid to the said right of way lands of the Grand Trunk Railway Company, and to fix the boundaries or limits thereof by durable monuments, to mark the proper lines of the above streets and roads.

Also on the petition of the Municipal Council of the City of Hamilton, instructions were issued to define the limits of Burlington Street in the City of Hamilton by durable monuments planted at the intersections of the base line or Burlington Street with James Street, Hughson Street, John Street, Catharine Street, Mary Street and Ferguson Avenue.

Also on the petition of the Municipal Council of the City of Port Arthur, instructions were issued to survey certain streets in the City of Port Arthur in the District of Thunder Bay, including North and South Water Streets, Cumberland Street, Court Street, and Algoma Street and all intersecting streets between John Street and McVicar Street, and to have the corners of the streets marked by iron bars duly planted thereat.

Also on the petition of the Municipality of Wolfe Island in the County of Frontenac, instructions were issued to survey the road allowance between the 3rd and 4th concessions south of the base line in the township of Wolfe Island in the County of Frontenac, across lots 8, 9 and 10, or as much farther on either side as may be necessary to find an original post and to plant durable monuments at the angles of the above lots.

Also on the petition of the Municipal Council of the town of Port Credit, instructions were issued to survey part of the town plot of Port Credit in the County of Peel, lying south-west of the River Credit and north-east of Joseph Street in the said village and to plant stone or other durable monuments at the front and rear angles of the blocks lying in that part of the village, as shown on annexed plan, pursuant to the provisions of the Surveys Act.

Also on the petition of the Municipal Council of the township of Ross, instructions were issued to survey the road allowance between concessions two and three, in the Township of Ross, from the proof line between lots ten and eleven south-easterly to Olmstead Lake, and to mark said road allowance by permanent monuments.

The following Municipal Surveys have been confirmed under the provisions of the Revised Statutes of Ontario, 1897, Chapter 181, Sections 14 and 15, such surveys being final and conclusive.

Survey of the boundary road allowance between the townships of Osnabruck and Cornwall and to have the said boundary marked by permanent stone or iron monuments at the expense of the municipality of the township of Osnabruck, in the County of Stormont.

Also the survey of the boundaries or limits of certain parts of the following public highways in the town of Oakville, namely, Dundas Street from the north-west limit of Sumner Street to the south-easterly limit of the right of way lands of the Grand Trunk Railway Company, and the "6th line road" from the westerly limit of Dundas Street aforesaid to the said right of way lands of the Grand Trunk Railway Company, and to fix the boundaries or limits thereof by durable monuments, to mark the proper lines of the above streets and roads.

Also the survey defining the limits of Burlington Street in the City of Hamilton by durable monuments planted at the intersections of the base line or Burlington Street with James Street, Hughson Street, John Street, Catharine Street, Mary Street and Ferguson Avenue.

Particulars relating to these surveys will be found in appendices 14 and 15, pages 46 and 47.

W. H. Hearst,
Minister.

Department of Lands, Forests and Mines,
Toronto, October 31st, 1914.

APPENDICES

Appendix No. 1.

Return of Officers and Clerks of the Department of Lands, Forests and Mines for the year ending October 31st, 1914.

Branch.	Name.	Designation.	When appointed.	Salary per annum.	Remarks.
				$ c.	
	Hon. W. H. Hearst	Minister	1911, Oct. 12	6,000 00	Also Prime Minister from October 2, 1914.
	Aubrey White	Deputy Minister	1882, Jan. 1	4,400 00	
	Geo. Kennedy	Law Clerk	1872, Feb. 1	2,900 00	
	C. C. Hele	Minister's Secretary	1912, Jan. 23	1,800 00	
	E. S. Williamson	Secretary to Department	1889, May 1	1,950 00	
	Janet Garvie	Clerk	1905, Jan. 1	825 00	
	James Farrington	Stenographer	1910, Dec. 14	800 00	
Sales and Free Grants	J. J. Murphy	Chief Clerk	1872, May 1	2,300 00	
	Walter C. Cain	Clerk of Free Grants	1903, March 6	1,750 00	
	W. R. Ledger	Clerk	1894, Feb. 5	1,450 00	
	Selby Draper	do	1903, Jan. 1	1,350 00	
	S. A. Platt	do	1907, March 13	1,100 00	
	F. Lucas	do	1909, March 24	1,100 00	
	F. Samuels	do	1909, March 24	925 00	
	W. B. Baines	do	1912, Oct. 5	950 00	
	May Bengough	Stenographer	1896, Oct. 23	750 00	
	Jean C. Oram	do	1907, Jan. 16	725 00	
	Nan McQueen	do	1909, March 24	725 00	
Military Grants.	H. E. Johnston	Chief Clerk	1907, March 13	1,600 00	
	E. F. O'Neil	Stenographer	1904, Nov. 9	725 00	
Surveys	G. B. Kirkpatrick	Director of Surveys	1866, Jan. 30	2,700 00	
	L. V. Rorke	Surveyor and Draughtsman.	1909, May 1	2,600 00	
	James Hutcheon	Assistant Surveyor and Draughtsman	1913, May 20	2,150 00	
	W. F. Lewis	Clerk	1872, May 5	1,400 00	
	D. G. Boyd	Draughtsman	1897, Sept. 27	1,650 00	
	E. M. Jarvis	Clerk	1904, Oct. 19	1,400 00	
	J. B. Proctor	do	1897, Jan. 15	1,200 00	
	H. Treeby	Draughtsman	1904, Jan. 13	1,250 00	
	John Work	do	1911, March 3	1,250 00	
	F. E. Blanchet	do	1907, March 13	1,100 00	
	A. Leaman	do	1909, March 24	1,100 00	

	B. Rushford	Draughtsman	1912, Oct. 5	1,000 00
	M. H. Kirkland	Stenographer	1904, Nov. 23	725 00
	E. G. Halliday	do	1909, March 24	725 00
	E. C. Armer	do	1911, March 3	625 00
	B. Benson	do	1911, March 3	625 00
	C. O'Connor	do	1911, March 3	625 00
Patents	C. S. Jones	Chief Clerk	1890, May 22	2,050 00
	C. E. Burns	Clerk	1900, April 9	1,450 00
	W. S. Sutherland	do	1902, Jan. 13	1,350 00
	W. Carrell	do	1904, Jan. 15	1,250 00
	A. E. Robillard	do	1894, May 8	1,000 00
	A. E. Roe	do	1909, March 24	1,250 00
Woods and Forests	J. A. G. Crozier	Chief Clerk	1867, Dec. 1	2,300 00
	J. B. Cook	Clerk	1898, Aug. 1	1,750 00
	H. Gillard	do	1900, April 9	1,500 00
	F. J. Niven	do	1903, March 6	1,350 00
	W. F. Trivett	do	1904, Jan. 13	1,300 00
	R. H. Hodgson	do	1904, Nov. 23	1,200 00
	J. Houser	do	1907, March 13	1,400 00
	A. H. O'Neil	do	1909, March 24	1,000 00
	G. W. Harris	do	1909, March 24	1,000 00
	N. L. Rogers	do	1911, Nov. 1	950 00
	S. D. Meeking	do	1910, June 1	900 00
	A. P. Saunders	do	1913, April 30	850 00
	Amy Thompson	Stenographer	1909, March 24	775 00
	M. E. Bliss	do	1909, Sept. 1	700 00
Accounts	D. G. Ross	Accountant	1861, April 15	2,550 00
	H. M. Lount	Clerk	1904, Jan. 13	1,550 00
	C. J. Clarke	do	1907, March 13	1,150 00
	R. Gordon	do	1913, April 30	850 00
	C. Bowland	Clerk and Stenographer	1911, March 3	700 00
	F. Yeigh	Registrar	1880, March 1	1,600 00
	Chester Dies	Clerk	1907, March 13	1,250 00
Forestry	E. J. Zavitz	Director	1912, Nov. 7	2,600 00
	F. S. Newman	Assistant Director	1913, Sept. 22	1,600 00
	Julia Bald	Stenographer	1914, Oct. 28	600 00
Bureau of Mines	Thos. W. Gibson	Deputy Minister	1891, June 19	4,000 00
	R. D. Fisher	Secretary	1907, March 13	1,350 00

Appendix No. 1.—Concluded.

Return of Officers and Clerks of the Department of Lands, Forests and Mines for the year ending October 31st, 1914.

Branch.	Name.	Designation.	When appointed.	Salary per annum.	Remarks.
				$ c.	
Bureau of Mines	W. H. Morris	Clerk	1906, Jan. 1	1,150 00	Transferred to Mining Commissioner's Office, Oct. 9th, 1914.
	W. Lemoine	do	1908, April 8	1,150 00	
	A. Burritt	do	1908, April 8	1,150 00	
	D. H. Barr	do	1907, March 13	1,150 00	
	Anne Moffatt	do	1901, March 1	1,100 00	
	A. G. Scovell	do	1909, March 24	1,050 00	
	C. W. St. John	do	1910, April 14	1,000 00	
	Ethel Craig	Clerk and Stenographer	1906, May 16	800 00	
	Flossie McDougall	do do	1907, March 13	725 00	
	J. L. McNaughton	Stenographer	1909, March 24	750 00	
	H. W. Batchelor	do	1911, Dec. 19	650 00	
	H. Brophy	Messenger	1898, Oct. 1	925 00	

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 2.

List of Land Agents and Homestead Inspectors for the year ending October 31st, 1914.

Name.	Post office address	District or county.	Date of appointment.	Salary per annum.	Remarks.
				$ c.	
Anderson, T. V.	Hearst	Part District of Algoma	1913, May 9	500 00	
Baker, R. H.	Minden	Part of Victoria	1907, Oct. 1	350 00	
Barr, Jas.	Fort Frances	Homestead Inspector	1906, Nov. 23	1,200 00	
Bastien, J. A.	Chelmsford	Homestead Inspector	1913, May 2	600 00	
Bolger, J. W.	New Liskeard	Lake Temiskaming District of Nipissing	1913, July 17	700 00	
Both, Chas.	Denbigh	Part of Frontenac and Addington	1905, Oct. 20	200 00	
Brown, J. B.	Bracebridge	Homestead Inspector and Crown Land Agent	1905, July 28	1,000 00	
Byers, R. J.	Massey	Part District of Sudbury	1905, July 3	500 00	
Buchanan, T.	Thessalon	do do Algoma	1901, Nov. 30	300 00	
Burrows, W. A.	Port Arthur	do do Thunder Bay	1912, Jan. 30	700 00	
Burnes, C. W.	Sundridge	Homestead Inspector	1905, Nov. 15	900 00	
Cameron, Wm.	Stratton Station	Part District of Rainy River	1911, April 27	500 00	
Campbell, I. M.	Parry Sound	do do Parry Sound	1914, Nov. 15	500 00	
Cragg, W. V.	New Liskeard	Homestead Inspector	1913, April 1	1,200 00	
Dean, Thos.	Sault Ste Marie	do	1908, July 29	600 00	
Dempsay, S. J.	Cochrane	Part of District of Nipissing	1911, Feb. 1	600 00	
Douglas, W. J.	Greenview	do Hastings	1912, June 1	500 00	
Ellis, H. J.	Powassan	do District of Parry Sound	1909, May 20	500 00	
Freeborn, Dr. J. S.	Magnetawan	do do do	1905. Nov. 10	500 00	
Ginn, F. E.	Matheson	do do Nipissing	1912, March 20	600 00	
Hales, W.	Apsley	do County of Peterboro	1911, July 17	250 00	
Hayes, G.	Dryden	District of Rainy River	1914, June 1	500 00	
Hollands, C. J.	Fort Frances	Part Townplot of Alberta and part District of Rainy River	1892, Oct. 12	300 00	
Hughes, Thos.	Murillo	Homestead Inspector	1908, July 20	800 00	
Jenkin, Wm.	Emsdale	Part of District of Parry Sound	1908, July 29	500 00	
Langlois, E.	Warren	do do Sudbury	1911, April 4	500 00	
Lemieux, J. A.	Blezard Valley	do do do	1908, July 1	400 00	
MacLennan, J. K.	Sudbury	do do do	1905, July 3	500 00	
McFayden, A.	Emo	do do Rainy River	1905, Sept. 8	500 00	

Appendix No. 2.—Concluded.

List of Land Agents and Homestead Inspectors for the year ending October 31st, 1914.—*Concluded.*

Name.	Post office address	District or county.	Date of appointment.	Salary per annum.	Remarks.
				$ c.	
Mulvaney, N.	Espanola Station.	Part of District of Algoma	1912, June 1.	200 00	Resigned Aug. 31st, 1914.
Noble, E.	Sault Ste. Marie	do do do	1913, Feb. 1.	300 00	
Parsons, W. J.	North Bay	do do Nipissing	1908, April 8.	500 00	
Philion, J. A.	Sturgeon Falls	do do do	1907, Sept. 13.	500 00	
Powell, F. R.	Parry Sound	do do Parry Sound			
Prince, A.	Wilno	do Renfrew	1907, May 31.	500 00	Resigned March 31st, 1914.
Pronger, R. H.	Dryden	District of Rainy River	1905, July 12.	500 00	
Quenneville, I.	Sturgeon Falls	Homestead Inspector	1906, May 7.	500 00	Resigned June 1st, 1914.
Small, R.	Mattawa	Part District of Nipissing	1906, May 7.	600 00	
Smith, Dalton	Cochrane	Homestead Inspector	1910, June 30.	500 00	
Spry, W. L.	Kenora	Part District of Rainy River	1912, April 16	1,000 00	
Watson, T. P.	Englehart	Homestead Inspector	1909, Sept. 21	400 00	Also Mining Recorder.
Watt, F.	Pembroke	Part of Renfrew	1905, May 10.	1,000 00	
Wilson, James	Kinmount	do Peterboro	1913, May 28.	300 00	
Whybourne, W. E.	Marksville	do St. Joseph Island	1905, May 31.	175 00	
Woollings, J.	Englehart	do District of Nipissing	1905, April 7.	250 00	
			1908, June 30.	600 00	

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 3.

Statement of Lands Sold and Leased. Amount of Sales and Leases and Amount of Collections for the year ending October 31st, 1914.

Service.	Acres sold and leased.	Amount of sales and leases.	Collection on sales and leases.
Lands Sold:		$ c.	$ c.
Agricultural and Townsites	137,666.06	98,030 68	83,529 50
Mining	17,383.53	43,763 31	41,027 50
Clergy	447	256 50	1,367 56
Common School	....	....	4,978 03
Grammar School	25	43 75	957 91
University	6,047	3,023 50	2,498 74
Lands Leased:			
Mining	5,837.61	5,837 61	16,469 76
Crown	7,555.22	5,749 06	40,755 48
	174,961.42	$156,704 41	$191,584 48

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 4.

Statement of Revenue of the Department of Lands, Forests and Mines for the year ending October 31st, 1914.

Service.	$ c.	$ c.	$ c.
LAND COLLECTIONS.			
Crown Lands:			
Agricultural	81,418 82		
Townsites	2,110 68		
		83,529 50	
Mining	....	41,027 50	
		124,557 00	
Clergy Lands	1,367 56		
Common School Lands	4,978 03		
Grammar School Lands	957 91		
University Lands	2,498 74		
		9,802 24	
Rent:			
Mining Leases	16,469 76		
Crown Leases	40,755 48		
		57,225 24	
Miners' Licenses	34,160 55		
Permits	860 00		
Recording Fees	29,174 71		
		64,195 26	
Royalties	....	74,685 11	
Supplementary Revenue:			
Acreage Tax	10,046 41		
Profit Tax	272,610 89		
Gas Tax	24,204 10		
		306,861 40	
			637,326 25
WOODS AND FORESTS.			
Bonus	....	454,167 24	
Timber Dues	....	1,112,480 38	
Ground Rent	....	103,910 31	
Transfer Fees	....	4,330 00	
			1,674,887 93
Provincial Assay Fees	361 52		
Casual Fees	755 68		
Cullers' Fees	116 15		
		1,233 35	
Algonquin Park	4,831 28		
Quetico Provincial Park	254 84		
Forest Reserves	730 50		
		5,816 62	
			7,049 97
REFUNDS.			
Fire Ranging	....	18,437 47	
Wood Ranging	....	2,421 00	
Estimating Timber Berths	....	350 00	
Agents' Salaries	....	88 50	
Mining Recorders	....	62 00	
Surveys	....	23 94	
Bureau of Mines	....	6 00	
Northern Development	....	4 01	
			21,392 92
			$2,340,657 07

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 5.

Statement of Receipts of the Department of Lands, Forests and Mines for the year ending October 31st, 1914, which are considered as Special Funds.

Service.	$ c.	$ c.
Clergy Lands.		
Principal	878 00	
Interest	489 56	
		1,367 56
Common School Lands.		
Principal	1,842 23	
Interest	3,135 80	
		4,978 03
Grammar School Lands.		
Principal	536 43	
Interest	421 48	
		957 91
University Lands.		
Principal	2,240 83	
Interest	257 91	
		2,498 74
		$9.802 24

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 6.

Statement of Disbursements of the Department of Lands, Forests and Mines for the year ending October 31st, 1914.

Service.	$ c.	$ c.	$ c.
AGENTS' SALARIES AND DISBURSEMENTS.			
Land, $16,885.77.			
Anderson, T. V.	500 00		
Disbursements	17 26		
		517 26	
Baker, R. H.	350 00		
Disbursements	4 25		
		354 25	
Both, C.	....	158 33	
Bolger, J. W.	632 59		
Disbursements	74 62		
		707 21	
Brown, J. B.	966 67		
Disbursements	303 15		
		1,269 82	
Buchanan, T.	....	300 00	
Burrows, W. A.	650 00		
Disbursements	106 65		
		756 65	
Byers, R. J.	500 00		
Disbursements	5 14		
		505 14	
Cameron, W.	500 00		
Disbursements	56 55		
		556 55	
Campbell, Miss I. M.	291 67		
Disbursements	22 00		
		313 67	
Dempsay, S. J.	600 00		
Disbursements	33 40		
		633 40	
Douglas, W. J.	500 00		
Disbursements	23 50		
		523 50	
Ellis, H. J.	....	500 00	
Freeborn, Dr. J. S.	500 00		
Disbursements	14 35		
		514 35	
Ginn, F. E.	600 00		
Disbursements	94 05		
		694 05	
Hales, W.	....	250 00	
Hayes, G.	....	208 34	
Hollands, C. J	....	300 00	
Jenkin, W.	500 00		
Disbursements	8 32		
		508 32	
Langlois, E.	500 00		
Disbursements	7 20		
		507 20	
Lemieux, J. A.	....	400 00	
MacLennan, J. K.	500 00		
Disbursements	42 15		
		542 15	
Brought forward		11,020 19	

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		11,020 19	
AGENTS' SALARIES AND DISBURSEMENTS.—*Continued*			
Land.—Concluded.			
McFayden, A.	500 00		
Disbursements	89 44		
		589 44	
Mulvaney, N.	133 33		
Disbursements	8 65		
		141 98	
Noble, E.		300 00	
Parsons, W. J.	500 00		
Disbursements	17 50		
		517 50	
Philion, J. A.	500 00		
Disbursements	19 57		
		519 57	
Powell, F. R.	208 33		
Disbursements	8 50		
		216 83	
Prince, A.	500 00		
Disbursements	15 50		
		515 50	
Pronger, R. H.	250 00		
Disbursements	43 80		
		293 80	
Small, R.	500 00		
Disbursements	15 75		
		515 75	
Spry, W. L.	400 00		
Disbursements	443 50		
		843 50	
Watt, F.		300 00	
Whybourne, W. E.	250 00		
Disbursements	9 95		
		259 95	
Wilson, J.	175 00		
Disbursements	13 51		
		188 51	
Woollings, J.	600 00		
Disbursements	63 25		
		663 25	
Homestead Inspectors, $11,911.29.			
Barr, J.	1,200 00		
Disbursements	1,211 80		
		2,411 80	
Bastien, J. A.	600 00		
Disbursements	318 10		
		918 10	
Burnes, C. W.	900 00		
Disbursements	480 06		
		1,380 06	
Cragg, W. V.	1,200 00		
Disbursements	385 48		
		1,585 48	
Dean, T.	600 00		
Disbursements	27 90		
		627 90	
Carried forward		23,809 11	

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		23,809 11	
AGENTS' SALARIES AND DISBURSEMENTS.—*Continued*			
Homestead Inspectors.—Concluded.			
Hughes, T.	800 00		
Disbursements	529 20		
		1,329 20	
Quenneville, I.	600 00		
Disbursements	150 20		
		750 20	
Smith, D.	1,000 00		
Disbursements	440 75		
		1,440 75	
Watson, T. P.	1,000 00		
Disbursements	467 00		
		1,467 80	
Timber, $30,826.48.			
Bremner, G.	1,241 66		
Disbursements	334 65		
		1,576 31	
Christie, W. P.	1,600 00		
Disbursements	372 19		
		1,972 19	
Hawkins, S. J.	1,500 00		
Disbursements	433 13		
		1,933 13	
Henderson, C.	1,800 00		
Webster, W. A., Assistant	1,600 00		
Disbursements	512 87		
		3,912 87	
Johnson, S. M.	1,600 00		
Disbursements	205 03		
		1,805 03	
MacDonald, S. C.	1,600 00		
Disbursements	263 35		
		1,863 35	
Margach, W.	1,600 00		
Legris, J., Assistant	1,300 00		
Disbursements	2,083 47		
		4,983 47	
Maughan, J.	1,500 00		
Disbursements	432 59		
		1,932 59	
McDonald, H.	1,500 00		
Disbursements	400 68		
		1,900 68	
McDougall, J. T.	1,600 00		
Disbursements	464 29		
		2,064 29	
Oliver, J. A.	1,500 00		
Penfold, G. S., Clerk	800 00		
Disbursements	603 67		
		2,903 67	
Stevenson, A.	1,500 00		
Disbursements	696 00		
		2,196 00	
Watts, G.	1,500 00		
Disbursements	282 90		
		1,782 90	
Carried forward		59,623 54	

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		59,623 54	
AGENTS' SALARIES AND DISBURSEMENTS.—*Concluded*			
Miscellaneous, $2,707.60.			
Alcock, G. H., Inspecting Lots in Township Melick		21 00	
Ames, D. H., Caretaker Islands in Dog and Laboria Lakes		20 00	
Bilton, G., Caretaker Islands in North and South Crosby		25 00	
Guthrie, W., Caretaker Islands in Devil's Lake		25 00	
Galbraith, W., Inspecting Island of Ketura in Lake Muskoka		19 50	
Margach, J. A., Inspecting Location LK16		13 95	
Moran, A., Inspecting Lots in Township of Burns		415 00	
McArthur, T. A., Inspector of Agencies	600 00		
Disbursements	521 65		
		1,121 65	
Stewart, J. A., Inspection of Townships Marquis, Otto, Pacaud and Evelyn		685 45	
Wigle, R. G., Inspecting various Lots		361 05	
			62,331 14
OTTAWA AGENCY.			
Darby, E. J., Agent		1,500 00	
Larose, S. C., Clerk		1,000 00	
Rent	508 33		
Disbursements	103 04		
		611 37	
WOOD RANGING.			3,111 37
Allan, Geo.		114 00	
Allen, R. A.		840 00	
Ansley, W. E.		855 00	
Arnill, Wm.		1,080 00	
Atcheson, Ira M.		570 00	
Bailey, S. I.	1,481 25		
Disbursements	137 90		
		1,619 15	
Barrett, Thos.		910 00	
Bates, R.		620 00	
Bedard, L.		129 00	
Beddome, W. E.		512 00	
Binnie, T.		736 00	
Bliss, L. E.	910 00		
Disbursements	808 26		
		1,718 26	
Boland, A. G.	910 00		
Disbursements	264 89		
		1,174 89	
Boyer, Geo.		81 00	
Buchanan, R.		191 25	
Buie, D.		622 73	
Buisson, Wm.		665 00	
Butterfield, J.		468 75	
Callaghan, T.		664 00	
Cameron, R.		408 00	
Cameron, J.		891 25	
Campbell, John		415 00	
Carlson, C.		65 00	
Carmichael, S.		177 00	
		15,527 28	
Carried forward			65,442 51

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		15,527 28	65,442 51
WOOD RANGING.—*Continued.*			
Carnfel, D.		324 75	
Carter, G.		516 00	
Castonguay, A. C.		975 00	
Caswell, G.		207 00	
Charette, H.		456 00	
Chenier, D. A.		995 00	
Christie, W. P. ....Disbursements.		12 85	
Clark, W. R.		560 00	
Cloud, Wm.		369 00	
Comer, B. F.		496 00	
Conture, Dan		156 00	
Corrigan, R. T.		1,050 00	
Coones, R.		331 00	
Coyne, Phin.		770 00	
Cross, R. J.		516 00	
Currie, J. E.		156 00	
Didier, H.		1,235 00	
Dougherty, J. M.		60 00	
Durrell, Wm.		1,230 00	
Duval, C. A.		715 00	
Eaton, C.		232 50	
Eaton, L.		190 50	
Edye, W. K.		448 00	
Elliott, Wm.		516 25	
Fairbairn, N. H.		44 00	
Faulkner, J.		455 00	
Faulkner, W.		296 00	
Ferguson, E. A.		1,040 00	
Fiddes, J.		328 00	
Fisher, Geo.		1,019 00	
Fraser, W. A.		905 00	
Fraser, D.		865 00	
Fraser, T.		120 00	
Frechette, O.	1,040 25		
Disbursements	75 90		
		1,116 15	
Frechette, E.		344 25	
Gamey, W. H.		695 00	
Gill, C.	676 00		
Disbursements	18 25		
		694 25	
Gilligan, E.		1,550 00	
Gordon, J. B.		45 00	
Gravelle, F.		312 75	
Griffith, Thos. ....Disbursements		158 15	
Hagan, E. G.		630 00	
Harkins, J. J.		352 00	
Hartley, Chas.		1,090 00	
Henderson, Chas. ....Disbursements.		1,499 01	
Henderson, A.		972 25	
Hey, Ben.		592 00	
Huckson, A. H.	645 00		
Disbursements	117 81		
		762 81	
Hurdman, W. H.		350 00	
Hutton, John		1,095 00	
Irving, E.		504 00	
Jean, A.		381 00	
Johnston, T.		1,224 00	
Carried forward		47,284 75	65,442 51

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		47,284 75	65,442 51
WOOD RANGING.—*Continued.*			
Kay, A.		296 00	
Kearney, D.		102 00	
Kelly, F.		55 00	
Lamore, P.		172 50	
Leblanc, O.		300 00	
Leblanc, E.		419 25	
Lee, J. B.		925 00	
Leroy, L. H.		240 00	
Linklater, John		125 00	
Lockhart, W. H.		32 50	
Long, H. E.		910 00	
Lowe, W. C.		360 00	
MacDonald, S. C. ....Disbursements		16 04	
Macdonell, R. D.		745 00	
Manice, Wm.		1,090 00	
Mann, John		500 00	
Margach, Wm. ....Disbursements		846 75	
Margach, J. A.	961 00		
Disbursements	56 75		
		1,017 75	
Marr, H. S.		576 00	
Martin, E.		444 00	
Maughan, J. ....Disbursements		29 40	
Menzies, A.		1,565 00	
Merchant, J.		294 00	
Milway, J. H.		1,560 00	
Misservia, T.		56 25	
Molyneaux, G.		725 00	
Montroy, J. J.		28 00	
Mooney, L.	1,792 00		
Disbursements	353 13		
		2,145 13	
Moran, A.		230 00	
Morel, H., Jr.		767 00	
Morin, D.		180 00	
Mulligan, J.		111 00	
Murphy, P.		111 00	
Murray, Wm.		1,520 00	
McAuley, W. D.		706 73	
McCaw, J. G.		1,560 00	
McDonald, J. D.	1,605 00		
Disbursements	29 55		
		1,634 55	
McDonald, T.	1,494 00		
Disbursements	17 55		
		1,511 55	
McDonald, H. ....Disbursements		737 57	
McDougall, J. T. ....Disbursements		268 33	
McGregor, C. F.		635 00	
McGregor, Wm.		555 00	
McGillivray, D. D.		280 00	
McIvor, J. A.		936 00	
McIntyre, Robt.		75 00	
McInnis, A. D.	1,491 25		
Disbursements	36 90		
		1,528 15	
McKendry, W. B.		825 00	
McKenley, J. H.		345 00	
Carried forward		77,377 20	65,442 51

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward	....	77,377 20	65,442 51
WOOD RANGING.—*Continued.*			
McLean, J.	670 00		
Disbursements	102 95		
		772 95	
McLean, J. D.	366 00		
Disbursements	4 85		
		370 85	
McLaughlin, John	....	468 00	
McNabb, A.	....	1,040 00	
McPherson, J. S.	....	1,360 00	
McRae D. A.	....	573 00	
Nevison, W. H.	....	648 00	
Newburn, Wm.	....	645 00	
Niblett, Jas.	....	420 00	
Nicholas, D. G.	....	376 00	
Norgate, C.	....	496 00	
Oldscamp, Geo.	....	123 00	
Oliver, J. A. ....Disbursements	....	393 73	
Paul, C. A.	....	705 92	
Pigott, J.	....	840 00	
Pritchard, F.	....	243 25	
Purdy, John	....	405 00	
Reid, J. P.	....	210 00	
Revell, L. O.	....	1,555 00	
Ridley, Robt.	....	1,450 00	
Ritchie, J. F.	....	775 00	
Ritchie, A. W.	....	280 00	
Ross, S.	....	1,519 00	
Roy, O.	....	273 75	
Rusk, O.	880 00		
Disbursements	84 66		
		964 66	
Sanderson, D.	....	760 00	
Schroeder, F.	....	165 00	
Sharpe, Jas.	....	1,645 00	
Shaw, Alfred	....	950 00	
Shaw, D.	....	528 00	
Shields, F.	....	468 00	
Short, J.	....	384 00	
Simmons, A. G.	....	616 00	
Simpson, Wm.	....	1,320 00	
Smith, V.	....	94 50	
Smith, H. B.	145 00		
Disbursements	22 50		
		167 50	
Spaniel, A.	....	217 50	
Sparling, S. W.	....	412 00	
Spence, D.	....	835 00	
Spence, A.	....	55 00	
Stein, Paul	....	1,023 27	
Stewart, R.	....	575 00	
St. Laurent, J.	....	288 75	
Teasdale, J.	....	555 00	
Thompson, G. S.	....	300 00	
Thompson, W. B.	700 00		
Disbursements	176 95		
		876 95	
Thompson, J.	....	207 00	
Thorpe, T.	....	715 00	
Carried forward		107,443 78	65,442 51

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		107,443 78	65,442 51
WOOD RANGING.—*Concluded.*			
Tipping, P.		250 00	
Urquhart, A.		985 00	
Vincent, H. T.		1,195 00	
Wallace, F.		516 00	
Watts, J. J.		440 00	
Watts, W. B.		504 00	
Webster, W. A. ..... Disbursements		448 05	
White, A. T.		220 00	
Whelan, P. J.		1,565 00	
Williams, Fred.		142 50	
Williams, Wm.		186 00	
Wilkins, G. N.		875 00	
Wilson, D.	745 00		
Disbursements	49 60		
		794 60	
Wilson, R.		138 00	
Windle, Jas.		360 00	
Wylie, D. M.		10 00	
Young, R. J.	690 00		
Disbursements	134 71		
		824 71	
Yuill, Thos.		575 00	
Zavitz, E. J. ..... Disbursements		30 77	
			117,503 41
ESTIMATING FOREST RESERVES.			
Cloud, Wm.		90 00	
Henderson, Chas. ..... Disbursements		321 54	
McLean, John		150 00	
McLean, James D.		90 00	
			651 54
EXPLORATION AND ESTIMATION OF TIMBER BERTHS.			
Henderson, Chas. ..... Disbursements			307 85
FIRE RANGING.			
Adams, Alex.		352 50	
Allen, R. A.		809 00	
Allan, D. L.		294 00	
Allen, D.		330 00	
Allard, Geo.		327 50	
Alldred, O.		292 50	
Algoma Eastern Railway		87 59	
Armstrong, G.		305 00	
Armstrong, W. H.		337 50	
Armstrong, T. C.		317 50	
Arnott, Wm.		315 00	
Arnold & Bell, Limited		54 00	
Atchison, I. M.		345 00	
Atchison, J.		72 00	
Atkinson, H.		332 50	
Bailey, H.		325 00	
Baker, F. P.		332 50	
Barnell, G. B.		345 00	
Bartlett, G. W. ..... Disbursements		3,202 25	
Bartlett, Hugh		86 15	
Bartlett, Herb.		39 03	
Carried forward		8,901 52	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward	....	8,901 52	183,905 31
FIRE RANGING.—*Continued.*			
Behoniel, Geo.	....	80 00	
Bedell, E.	....	322 50	
Beddome, W. E.	....	121 00	
Beaumont, A.	....	300 00	
Begin, P.	....	341 25	
Begin, Dave	....	300 00	
Bellefeuille, M.	....	183 75	
Belanger, E.	....	355 00	
Belanger, E.	....	335 00	
Berry, Geo.	....	317 50	
Berrige, C. W.	....	322 50	
Bertrand, H.	....	360 00	
Biederman, Wm.	....	335 00	
Bisaillon, Leo.	....	322 50	
Bissonette, R.	....	317 50	
Bliss, L. E. ....Disbursements..	....	2,030 90	
Bliss, C. L.	....	889 00	
Blondin, A.	....	285 00	
Blair, B.	....	6 00	
Boice, R.	....	69 50	
Bookhout, H.	....	335 00	
Boon, Isaac	....	77 50	
Bonter, S.	....	357 50	
Both, C.	....	277 50	
Bowins, John	....	360 00	
Bottrell, Dan	....	345 00	
Bowes, John	....	297 50	
Bowland, J. J.	496 00		
Disbursements	77 75		
		573 75	
Bonwell, J. V.	....	115 00	
Box, Bert	....	340 00	
Brooks, A.	....	470 00	
Bromley, Ed.	....	227 50	
Brown, A.	....	345 00	
Brown, Thos.	....	325 00	
Brown, T. E.	....	300 00	
Brozeau, O.	....	355 00	
Brum, A.	555 00		
Disbursements	133 25		
		688 25	
Brum, C.	....	345 00	
Brunet, A.	....	312 50	
Buisson, W.	....	145 00	
Buie, D.	....	212 00	
Burger, Wm.	....	355 00	
Burton, D. B.	....	335 00	
Bunting, H. T.	....	345 00	
Campbell, A.	....	335 00	
Campbell, W. L.	....	292 50	
Campbell, J. S.	....	272 50	
Campbell, D.	....	362 50	
Carnochan, G.	....	355 00	
Case, G. W.	....	320 00	
Cavanagh, S.	....	345 00	
Chambers, Thos.	....	295 00	
Chaloner, C.	....	313 50	
Chapman, W.	....	335 00	
Carried forward	....	27,560 42	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		27,560 42	183,905 31
FIRE RANGING.—*Continued.*			
Chittick, W. J.		372 50	
Chenier, H.		182 50	
Christie, W. P. ....Disbursements		345 84	
Clark, H.		332 50	
Clayton, B.		22 76	
Cluff, R. A.		292 50	
Cocoa, Alex.		297 50	
Connell, Wm.		222 50	
Coombs, R.		12 50	
Conture, D.		362 50	
Cooper, A.		345 00	
Countryman, A. G.		335 00	
Cousineau, C.		345 00	
Coyne, P.	690 00		
Disbursements	140 17		
		830 17	
Crombie, V.		335 00	
Crawford, R. M.		317 50	
Crumb, Ben.		155 00	
Currell, Rich.		355 00	
Currie, D. H.		302 50	
Curry, P. W. M.		290 00	
Dance, H. L.		332 50	
Dean, A.		327 50	
Deschamp, N.		345 00	
Dickson, J.		355 00	
Dial, A. C.		337 50	
Didier, L. P.		957 00	
Dixon, A. J.		307 50	
Doolittle, R.		345 00	
Doyle, Gus.		335 00	
Drake, F.		337 50	
Duff, R. A.		470 00	
Dukes, V.		335 00	
Duncan, R.		313 50	
Durnin, C.		352 50	
Dyson, W.		12 50	
Edwards, G. H.		335 00	
Eilber, Geo.		355 00	
Elliott, Jack		330 00	
Elliott, G.		334 00	
Ellis, E. C.		320 00	
Ellsworth, C. B.		345 00	
Emerson, H.		335 00	
English, M.		357 50	
Evans C. S.		307 50	
Fairbairn, N. H.	825 00		
Disbursements	292 67		
		1,117 67	
Farrell, S. H.		325 00	
Favereau, Geo.		355 00	
Ferguson, T. H.		362 50	
Ferguson, Geo.		357 50	
Fitzgerald, G.		92 50	
Fitzgerald, Robt.		345 00	
Fitzbock, J.		359 50	
Fitzpatrick, P.		350 00	
Fisher, Geo.		396 00	
Carried forward		46,156 86	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		46,156 86	183,905 31
FIRE RANGING.—*Continued.*			
Flannigan, Jas.		335 00	
Flynn, M.		337 50	
Foley Bros. and Northern Construction Co.		138 06	
Fox, W. W.		310 00	
Fraser, W. A.		332 50	
Fraser, Alex.		352 50	
Frawley, M.		267 50	
Freele, L. W. M.		335 00	
Frenette, S.		335 00	
Furry, C.		357 50	
Gagne, F.	950 00		
Disbursements	223 95		
		1,173 95	
Gagne, J.		295 00	
Gale, W. J.		387 00	
Galt, R.		332 75	
Gardner, W. T.		312 50	
Gaskill, W. T.		65 00	
Garrow, G.		350 00	
Gauld. W. H.		257 50	
Gault, Jas.		345 00	
Gauthier, Theo.		355 00	
Gemmill, J.	516 00		
Disbursements	173 65		
		689 65	
Gillanders, G.		347 50	
Gooding, S.		282 50	
Griffin, D.		315 00	
Guthrie, Wm.		355 00	
Hackett, Wm.		337 50	
Hainstock, W. A.		220 00	
Hall, T.		335 00	
Hamond, D.		322 50	
Hammond, H.		313 50	
Hammond, W. S.		245 00	
Hand, Thos.		512 00	
Hanmer, Geo.		340 00	
Hardy, F.		357 50	
Hardingham, V. C.		335 00	
Harris E.		97 59	
Hatch, W.		68 71	
Henderson, Chas. ....Disbursements		221 69	
Henderson, J.		327 50	
Heroux, J.		352 50	
Hicks, A.		71 99	
Higgins, R.		265 00	
Hill, J. E.		297 50	
Holman, L.		8 08	
Holmes, J. H.		327 50	
Holt, J.		320 00	
Hollis, J.		312 50	
Hopkins, R. D.		312 50	
Hourigan, C.		335 00	
Huckson, A. H.	933 33		
Disbursements	292 00		
		1,225 33	
Hudgins, W. H.		337 50	
Carried forward		63,319 66	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		63,319 66	183,905 31
FIRE RANGING.—*Continued.*			
Humphreys, E.		322 50	
Hutcheson, G. T.		167 50	
Ingham, F.		322 50	
Irish, Wm.		425 00	
Jackson, W. H.		337 50	
Jackson, F. N.		355 00	
Jamieson, K.		337 50	
Jarvis, E.		317 50	
Jenkins, S.	642 00		
Disbursements	214 00		
		856 00	
Johnson, V. J.		237 50	
Johnston, W.		357 50	
Johnston, S.		285 00	
Jones, K. G.		257 50	
Judge, S. E.		165 00	
Keely, E. A.		355 00	
Kelly, T.		355 00	
Keenahan, Matt.		355 00	
Kells, L.		337 50	
Kennedy, T. A.		315 00	
Kerr, Alex.		307 50	
King's Printer		125 00	
Labbie, A.		335 00	
Lafontaine, P.		333 50	
Langford, T.		345 00	
Lanktree, J.		332 50	
Lamb, D.		345 00	
Lash, A.		195 00	
Laurin, J. A.		315 00	
Leblanc, O.		552 00	
Leblanc, F.		322 50	
Leblanc, O.		337 50	
Leblanc, R. W.		115 00	
Labelle, A.		335 00	
Leach, P.		335 00	
Leacy, J.		355 00	
Leddy, J.		322 50	
Lee, J. B.	760 00		
Disbursements	186 45		
		946 45	
Lee, E. J.		302 50	
Leggett, C.		355 00	
Lepper, R. H.		322 50	
Liddle, H.		335 00	
Linklater, W.		363 50	
Lloyd, W. H.		355 00	
Lockhart, W. H.		362 50	
Lofquist, M.		292 50	
Long, H. E.	885 00		
Disbursements	196 74		
		1,081 74	
Lougheed, C.		70 00	
Loy, R.		322 50	
Lumb, S. S.		327 50	
MacDonald, S. C. ....Disbursements		112 10	
Macdonell, R. D.		356 00	
MacEwen, B.		335 00	
Carried forward		81,328 45	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		81,328 45	183,905 31
FIRE RANGING.—*Continued.*			
MacGillivray, G.		265 00	
MacNeill, E. R.		355 00	
Mack, H.		115 00	
Mair, Wm.		330 00	
Margach, Wm. .... Disbursements		1,011 09	
Margach, J. A.		488 00	
Marshall, F. R.		300 00	
Marston, Wm.		315 00	
Martlin, R. F.		337 50	
Maxwell, A.		312 50	
May, H.	880 00		
Disbursements	257 46		
		1,137 46	
Merchant, J.		345 00	
Merchant, S. W.		332 50	
Mercer, G. A.		335 00	
Merritt Lumber Co.		21 00	
Miller, R.		335 00	
Molyneaux, Geo.	414 00		
Disbursements	103 50		
		517 50	
Morand, L.		355 00	
Morin, J.		355 00	
Morgan, J. H.		310 00	
Moore, Jas.		302 50	
Morris, N.		305 00	
Morris, D.		345 00	
Morrison, M. C.		315 00	
Mousseau, E.		297 50	
Mousseau, S.		297 50	
Moyles, J.		58 50	
Murphy, C.		320 00	
Myers, R. A.		317 50	
Myers, T. R.		287 50	
McAuley, W. D.		520 00	
McCadden, P.		322 50	
McCallum, A. J.		295 00	
McClellan, W. S.		337 50	
McCullough, D. J.		355 00	
McDonald, R. A.		170 00	
McDonald, A. J.		34 50	
McDonell, L. P.		345 00	
McIntyre, Peter		355 00	
McIntosh, J.		327 50	
McEwen, H.		327 50	
McKinnon, E.		335 00	
McKinnon, H.		332 50	
McKechnie, J.		335 00	
McKenzie, A.		100 00	
McKay, J. L.		87 50	
McLaughlin, John		172 50	
McLennan, D.		27 00	
McLeod, Wm.		332 50	
McLean, Dan.		297 50	
McMullen, S. J.		335 00	
McMullen, Wm.		340 00	
McNeely, M.		322 50	
McNevin, Alex.		345 00	
Carried forward		98,798 50	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		98,798 50	183,905 31
FIRE RANGING.—*Continued.*			
McPhee, D. J.		197 50	
McQuinn, W. J.		315 00	
McRae, D. A.		510 00	
Neelon, G. M.		457 00	
Nelson, Nels		192 50	
Netwegisis, A.		32 00	
Nepigon Construction Co.		53 40	
Newburn, Wm.		337 50	
Newhouse, A.		508 00	
Nevitt, J.		86 15	
Nichol, D. H.		337 50	
Nixon, W. H.		335 00	
Nockwinogis, S.		8 00	
O'Brien, M.		75 00	
O'Brien, J.		355 00	
O'Brien, Fowler and McDougall Bros.		61 49	
O'Grady, W. J.		250 00	
O'Neill, T.		297 50	
Oikle, A.		210 00	
Oliver, J. A. ...Disbursements		563 76	
Ouellette, F.		335 00	
Passmore, J.		277 50	
Patterson, B.		345 00	
Paul, C.		396 00	
Pecaski, J.		145 00	
Pecks, J.		2 00	
Pelletier, Peter		185 00	
Pierce, F.		310 00	
Pigeon, C.		26 00	
Piggot, J. A.		305 00	
Pingle, Alex.		335 00	
Piper, R.		300 00	
Poulin, N.		335 00	
Porter, B.		64 61	
Powell, John		115 00	
Powell, H. G.		335 00	
Presley, J.		305 00	
Pritchard, F.		501 75	
Rabbitts, Max		889 00	
Racey, M. J.		322 50	
Ranger, A.		305 00	
Rawson, C. L.		315 00	
Redden, M. A.		357 50	
Reeve, E. M.		292 50	
Reeve, A. S.		270 00	
Renshaw, A.		307 50	
Remus, C.		345 00	
Renton, G. M.		277 50	
Reid, Robert		117 50	
Reid, C. F.		425 00	
Reveler, Mac.		315 00	
Richardson, J. S.		345 00	
Rivers, S.		302 50	
Robertson, J.		99 61	
Rochfort, A.		355 00	
Rodden, M. J.		325 00	
Roe, N.		317 50	
Rose, A.		335 00	
Carried forward		115,217 27	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		115,217 27	183,905 31
FIRE RANGING.—*Continued.*			
Rousette, Jos.		115 00	
Row, James		357 50	
Rusk, O. W.	780 00		
Disbursements	2,820 07		
		3,600 07	
Ryan, T.		335 00	
Ryan, Wm.		322 50	
Sanderson, S.		335 00	
Saunders, H. A.		310 00	
Saunders, L.		265 00	
Sauve, John		327 50	
Savard, A.		317 50	
Scaffner, J.		325 00	
Schenk, N.		325 00	
Schoales, R.		335 00	
Schroeder, A.		315 00	
Scott, C. V.		295 00	
Scott, J.		145 00	
Scott, R.		520 00	
Seymour, R. F.		312 50	
Sheridon, W. E.		332 50	
Shilling, H.		551 00	
Shore, D.		355 00	
Simmons, A. F.		325 00	
Sinclair, A.		24 00	
Sloan, John		382 50	
Small, M. A.		317 50	
Smedley, A. E.		320 00	
Smellie, H.		55 00	
Smith, V.		525 00	
Smith, A.		7 30	
Smith, H.		320 00	
Smith, E. J.		332 50	
Snider, R. A.		332 50	
Solomon, J.		357 50	
Spence, A.		294 25	
Spence, D.		345 00	
Spence, C. A.		332 50	
Spreadborough, G. S.		335 00	
Spurr, Wm.		162 50	
Stark, S. W.		302 50	
Stewart, E. B.		192 50	
Stewart, Chas.		320 00	
Stewart, R.		335 00	
Stewart, C.		335 00	
Stewart, J. A.	850 00		
Disbursements	1,185 53		
		2,035 53	
Steward, W.		155 00	
Stevens, A.		327 50	
Stevens, W. J.		317 50	
Stevenson, G. H.		300 00	
Stevenson, R.		12 50	
Strathern, R.		335 00	
Sudds, D.		160 00	
Carried forward		135,209 42	183,905 31

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		135,209 42	183,905 31
FIRE RANGING.—*Concluded.*			
Sutherland, J. W.		322 50	
Superior Construction Co.		138 65	
Swanson, G.		285 00	
Swinson, C.		327 50	
Tang, John		352 50	
Taylor, C. J.		322 50	
Tibbetts, N. A.		272 50	
Tighe, T. J.		27 50	
Tillson, Andrew		185 00	
Thomas, P.		247 50	
Thompson, Ed.	399 00		
Disbursements	99 75		
		498 75	
Thompson, F. H.		327 50	
Thompson, T.		345 00	
Tooke, S.		320 00	
Toomer, S.		342 50	
Torrance, E. A.		170 00	
Tremblay, E.		330 00	
Tye, R. H.		75 00	
Urquhart, A.		468 00	
Valois, P.		330 00	
VanBowell, J.		25 00	
Wagner, Fred.		84 81	
Walker, Geo.		320 00	
Walton, H.		337 50	
Wallace, A.		315 00	
Washburn, B.		145 00	
Watts, Geo. .... Disbursements		225 77	
Watt, R. S.		345 00	
Wattie, W.		61 00	
Watson, M.		166 15	
Wease, A.		310 00	
Weir, G. A.		335 00	
Welsh, Jas.		345 00	
Wendt-Wreidt, A. J.		335 00	
Western, A. H.		305 00	
West, W.		302 50	
Westra, H.		317 50	
Whaley, H.		325 00	
Whiteman, F. H.		337 50	
Whytock, H.		332 50	
Wickens, H.		313 50	
Wilkins, G. N.		508 00	
Williams, R. A.		240 00	
Williams, S. E.		340 00	
Windell, Jas.		957 00	
Wood, W. D.		132 00	
Woodcock, Geo.		295 00	
Wright, J.		357 50	
Wright, A.		285 00	
Wright, H. H.		317 50	
Yeates, R. H.		355 00	
Young, R. R.		325 00	
			150,588 05
Carried forward			334,493 36

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward			334,493 36
FOREST RESERVES.			
Temagami Reserve, $42,137.90.			
Agarias, C.		315 00	
Albright, E.		317 50	
Albright, L.		210 00	
Allen, N. B.		305 00	
Armstrong, H. F.		330 00	
Axford, B. W.		315 00	
Baines, W. H.		332 50	
Barrett, Thos.	765 00		
Disbursements	588 42		
		1,353 42	
Battten, B. N.		307 50	
Beatty, J. B.		297 50	
Bell, W. D.		315 00	
Benson, R. E.		312 50	
Benoit, E.		320 00	
Bibet, L. A.		225 00	
Bovin, H.		312 50	
Bowden, G. S.		315 00	
Briggs, A. V.		237 50	
Bulman, R. J.		315 00	
Carpenter, P. J.		185 00	
Cavill, A. H.		330 00	
Champagne, I.		315 00	
Chase, F. E.		332 50	
Chennette, J.		320 00	
Coghill, J. R.		315 00	
Coombs, F. H.		310 00	
Craig, H. A.		320 00	
Cronk, G. S.		312 50	
D'Embremont, F.		310 00	
Desroisiers, J.		277 50	
Dickson, G. J.		185 00	
Duffy, W. J.		305 00	
Dunbar, J.		315 00	
Elliott, W. J.		112 50	
Emery, G. B.		332 50	
Evans, Wm.		315 00	
Faeris, R.		1,050 50	
Fick, D. R.		197 50	
Ford, Fred.		120 00	
Forsyth, G.		302 50	
Gibson, G. A. L.		297 50	
Goodearle, W. E.		302 50	
Greenrod, S.		332 50	
Grenier, J.		315 00	
Grenier, Alex.		82 50	
Hagerman, G. A.		332 50	
Hanley, A. F.		265 00	
Haines, H.		307 50	
Harris, B. J.		67 50	
Harrison, J. W.		430 00	
Henderson, C. ... Disbursements		10 30	
Hendrick, C. P.		332 50	
Herlihy, D.		260 00	
Carried forward		16,334 22	334,493 36

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		16,334 22	334,493 36
FOREST RESERVES.—*Continued.*			
Temagami Reserve.—Continued.			
Hindson, C. E.	1,300 00		
Disbursements	995 85		
		2,295 85	
Holstein, A.		315 00	
Inderwick, C. C.		312 50	
Kearns, R. C.		315 00	
Keenan, J. T.		332 50	
Kemp, W. S.		330 00	
Kennedy, Wm.		505 00	
Kirkup, N. N.		272 50	
Lamarche, A.		912 50	
Larmour, R. R.		315 00	
Levinge, S. T.		315 00	
Lewis, S. T.		332 50	
Livingston, J.		322 50	
Lord, T. V.		315 00	
Masson, D. M.		170 00	
Maynard, W. B.		270 00	
Mohr, C. B.		300 00	
Montrueil, J.		315 00	
Moore, C. A.		305 00	
Moorehouse, C.		185 00	
Mowat, A. M. G.		310 00	
Murphy, P.		192 50	
McCart, H. M.		332 50	
McKay, A.		315 00	
McLaughlin, John		10 00	
McLean, G. R.		267 50	
McLeish, W. J.		315 00	
McLeod, J. D.		332 50	
Nadon, P.		315 00	
Neil, Wm.		315 00	
Nicholas, H.		332 50	
O'Neil, W. S.		317 50	
Papineau, W. C.		317 50	
Passmore, S.		330 00	
Perron, M.		315 00	
Petrant, Wm.		312 50	
Philpot, G. M.		332 50	
Plaunt, N.		310 00	
Pratt, D.		70 00	
Price, D. W.		332 50	
Powell, J.		315 00	
Rankin, R. W.		315 00	
Reesor, Geo.		317 50	
Reid, F. L.		295 00	
Rochon, Jos.		462 50	
Roger, W. G.		315 00	
Routhier, E.		317 50	
Russell, F.		312 50	
Sage, P.		315 00	
Sasseville, Joe		302 50	
Sharp, J. F.		315 00	
Shelson, H.		315 00	
Carried forward		34,642 57	334,493 36

Appendix No. 6.--Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		34,642 57	334,493 36
FOREST RESERVES.—*Continued.*			
Temagami Reserve.—Concluded.			
Shields, R. H.		315 00	
Simpson, T.		307 50	
Smith, E. H.		315 00	
Smith, L.		302 50	
Sparks, W. E. L.		302 50	
Sutton, F.		315 00	
Swayze, D. A.		305 00	
Vivaris, D.		912 50	
Vivaris, M.		312 50	
Warren, P. S.		297 50	
Western, C.		332 50	
Western, E. A.		277 50	
White, Joseph		315 00	
White, James		312 50	
Whitney, K. H.		302 50	
Williams, Chas.		312 50	
Willoughby, J. B.		315 00	
Wilson, B.		317 50	
Winder, A.		315 00	
Young, R. J.	710 00		
Disbursements	300 33		
		1,010 33	
Metagami Reserve, $8,127.82.			
Armstrong, H. F.		147 50	
Burden, John	830 00		
Disbursements	390 32		
		1,220 32	
Gauthier, W.		345 00	
Jones, C. L.		197 50	
Lawrence, C. F.		300 00	
Lefroy, L. D.		57 50	
Logan, H.		337 50	
Marks, V. H.		345 00	
Melville, R.		342 50	
McDonald, J. A.		317 50	
McFayden, J.		337 50	
McLaughlin, J. S.		172 50	
McLennen, H.		147 50	
Navere, Thos.		190 00	
Neddry, R. J.		200 00	
Ogg, C. S.		342 50	
Patton, J.		342 50	
Perry, W. G.		317 50	
Reid, J.		380 00	
Rountree, C. S.		342 50	
Schwab, C. D.		342 50	
Tate, J.		385 00	
Taylor, W. J.		385 00	
Topp, J. V.		145 00	
Welch, L. S.		145 00	
Wickett, T. H.		342 50	
Carried forward		50,265 72	334,493 36

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		50,265 72	334,493 36
FOREST RESERVES.—*Continued.*			
Mississaga Reserve, $20,066.19.			
Acheson, L.		540 00	
Adams, W.		307 50	
Allen, Geo.		435 00	
Anderson, R. M.		272 50	
Belaney, A.		352 50	
Belanger, T.		430 00	
Bennett, J. O.		330 00	
Bickell, R. R.		336 00	
Buisson, Wm.		192 50	
Bulmer, A.		392 50	
Burden, J.		420 00	
Burden, Wm.		471 50	
Cameron, Geo.		332 50	
Causley, P.		422 50	
Dougherty, E.		342 50	
Dougherty, A. E.		325 00	
Draper, Wm.		315 00	
Duval, C. A.	935 00		
Disbursements	1,546 19		
		2,481 19	
Dyson, Isaac		322 50	
Evelene, A.		180 00	
Evelene, S.		272 50	
Featherstonehaugh, M. H.		327 50	
Flinchbaugh, A. B.		325 00	
Foreman, H. R.		312 50	
Fraser, Thos.		77 50	
Fyke, L.		330 00	
Gordon, T. S.		307 50	
Greer, D. G.		330 00	
Hamm, S. C.		210 00	
Hargrave, H. R.		297 50	
Hays, C.		392 50	
Hogarth, J.		277 50	
Jean, A.		437 50	
Knox, D.		430 00	
Leffler, R. D.		32 50	
Luke, Sam		222 50	
Miller, N. J.		222 50	
Morel, H.		392 50	
McAuley, Robt.		330 00	
McGrath, B.		317 50	
McKenzie, Alex.		85 00	
McLaughlin, John		192 50	
Orange, W. H.		230 00	
Patterson, M.		317 50	
Pickaske, John		130 00	
Philips, H.		280 00	
Philips, Colin		130 00	
Philips, Theo.		45 00	
Richardson, G. B.		182 50	
Saunders, J.		232 50	
Sawyer, E. C.		280 00	
Scott, W. W.		317 50	
Scott, J. H.		192 50	
Carried forward		67,926 91	334,493 36

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		67,926 91	334,493 36
Forest Reserves.—*Continued.*			
Mississaga Reserve.—Concluded.			
Sherlock, A. E.		310 00	
Slater, Wm.		315 00	
Spanial, J.		125 00	
Strachnan, J. G.		292 50	
Taylor, C. N.		420 00	
Thorne, L.		30 00	
Washburn, B. L.		190 00	
Williams, Chas.		80 00	
Wilson, R. H.		317 50	
Wyatt, R. E.		325 00	
Nepigon Reserve. $13.234.90.			
Backhurst, J.		37 50	
Barker, C.		352 50	
Blair, Bert		417 50	
Bliss, L. E.	765 00		
Disbursements	3,341 40		
		4,106 40	
Bouchard, J.		473 50	
Bouchard, M.		102 50	
Connell, Wm.		67 50	
Crumb, B.		170 00	
Dawkins, John		207 50	
Dawa, J. O.		102 50	
Dawa, J.		97 50	
Dier, J.		398 50	
Dixon, A. J.		45 00	
Esquago, P.		10 00	
Ferris, R. H.		357 50	
Fountain, H. A.		335 00	
Fraser, Alex.		187 50	
Gray, E. L.		355 00	
Husband, A. C.		345 00	
Hutcheson, G. F.		175 00	
Judge, S. E.		152 50	
Lafontaine, P.		77 50	
Legard, J.		80 00	
Meredith, T. R.		355 00	
Micholson, J.		395 00	
Monahan, P.		187 50	
Nelson, Nels.		62 50	
Netmegesic, F.		60 50	
Netinigesic, A.		300 00	
Nighbor, F. J.		340 00	
Nockwenoges, Luke		8 00	
Pigeon, C.		347 50	
Rae, A.		451 50	
Salsbury, M.		540 00	
Sanderson, C. E.		347 50	
Shilling, H.		87 00	
Stewart, W.		170 00	
Torrance, E. A.		185 00	
Tyrrell, Geo.		202 50	
Ward, Jas.		494 50	
Wawai, M.		47 50	
Carried forward		83,566 81	334,493 36

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		83,566 81	334,493 36
FOREST RESERVES.—*Concluded.*			
Eastern Reserve, $2,828.85.			
Brooks, M.		345 00	
Drysdale, Samuel		345 00	
McGregor, D.		345 00	
Smith, Chas.		345 00	
Snider, L.		345 00	
Stewart, Wm.		345 00	
Tapping, Thos.	600 00		
Disbursements	158 85		
		758 85	
Sibley Reserve, $705.00.			
Hornick, Geo.		302 50	
Oliver, J. A.		100 00	
Quinn, J. J.		302 50	
			87,100 66
FORESTRY.			
Newman, F. S., travelling expenses		31 20	
Bell Telephone Company	32 75		
Express and cartage	65 57		
		98 32	
Supplies		2,099 97	
Labor		6,150 30	
Sundries		190 55	
			8,570 34
MINES AND MINING.			
Miller, W. G., Provincial Geologist, services	4,550 00		
Disbursements	421 01		
		4,971 01	
Knight, C. W., 1st Assistant Geologist, services	2,250 00		
Disbursements	802 55		
		3,052 55	
Burrows, A. G., 2nd Assistant Geologist, services	2,150 00		
Disbursements	436 48		
		2,586 48	
Hopkins, P. E., 3rd Assistant Geologist, services	1,049 04		
Disbursements	418 17		
		1,467 21	
Mickle, G. R., Mine Assessor, services	4,000 00		
Disbursements	620 48		
		4,620 48	
Godson, T. E., Mining Commissioner, services	4,300 00		
Dance, R. W., Mining Commissioner's Clerk, services	1,408 55		
Morris, W. H., Mining Commissioner's Clerk, services	86 26		
Disbursements	1,010 65		
		6,805 46	
Sutherland, T. F., Inspector of Mines, services	2,500 00		
Disbursements	756 63		
		3,256 63	
Collins, E. A., 1st Assistant Inspector of Mines, services	2,300 00		
Disbursements	1,459 65		
		3,759 65	
Carried forward		30,519 47	430,164 36

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		30,519 47	430,164 36
MINES AND MINING.—*Concluded.*			
McMillan, J. G., 2nd Assistant Inspector of Mines, services	2,300 00		
Disbursements	666 09		
		2,966 09	
Bartlett, J., 3rd Assistant Inspector of Mines, services	1,200 00		
Disbursements	910 05		
		2,110 05	
McKay, A. A., 4th Assistant Inspector of Mines.. Disbursements		557 35	
Rogers, W. R., Topographer, services	1,850 00		
Disbursements	38 65		
		1,888 65	
Bell, W. J., Cartographer, services	1,245 17		
Disbursements	250 00		
		1,495 17	
McArthur, T. A., Inspector of Recorders' Offices, services	700 00		
Disbursements	368 25		
		1,068 25	
Berry, J. W., services		55 00	
Greenland, C. W., services	303 85		
Disbursements	62 05		
		365 90	
Near, A. E., services	257 67		
Disbursements	81 15		
		338 82	
Parsons, A. L., services	423 08		
Disbursements	423 75		
		846 83	
Scott, John, services	658 34		
Disbursements	333 06		
		991 40	
Sharpe, D., services	423 67		
Disbursements	242 55		
		666 22	
King's Printer		88 73	
Methodist Book Room		11 11	
Express		116 20	
Sundries		68 26	
			44,153 50
MINING RECORDERS.			
Bowker, S. T., Recorder	1,000 00		
Disbursements	324 47		
		1,324 47	
Campbell, C. A., Recorder	900 00		
Washburn, H. C., Clerk	57 69		
Glazier, M. B., Clerk	180 00		
Young, Miss E., Stenographer	358 26		
Shanahan, Miss M., Stenographer	147 69		
Disbursements	376 20		
		2,019 84	
Gauthier, G. H., Recorder	1,500 00		
Graham, F. W., Clerk	1,203 85		
O'Brien, J. D., Clerk	1,023 27		
Disbursements	364 55		
		4,091 67	
Carried forward		7,435 98	474,317 86

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward		7,435 98	474,317 86
MINING RECORDERS.—*Concluded.*			
Hough, J. A., Recorder	1,200 00		
Browning, A. J., Clerk	1,000 00		
Glazier, M. B., Clerk	190 38		
Gardiner, Miss I. M., Stenographer	631 49		
Disbursements	682 55		
		3,704 42	
McQuire, H. F., Recorder	500 00		
Disbursements	152 90		
		652 90	
Morgan, J. W., Recorder	1,000 00		
Disbursements	315 80		
		1,315 80	
Sheppard, H. E., Recorder	1,000 00		
Glazier, M. B., Clerk	93 46		
Disbursements	199 60		
		1,293 06	
Skill, A., Recorder	1,200 00		
Glazier, M. B., Clerk	93 46		
Disbursements	66 26		
		1,359 72	
Smith, G. T., Recorder	2,363 44		
Sarsfield, J. M., Clerk	1,163 44		
Ferguson, L. H., Clerk	333 00		
Monroe, Miss E., Stenographer	760 25		
Smith, Miss M. H., Stenographer	579 68		
Disbursements	779 10		
		5,978 91	
Spry, W. L., Recorder	723 69		
Disbursements	20 00		
		743 69	
Express	93 09		
King's Printer	509 96		
Methodist Book Room	55 64		
		658 69	
PROVINCIAL ASSAY OFFICE.			23,143 17
McNeill, W. K.	1,800 00		
Disbursements	19 04		
		1,819 04	
Rothwell, T. E.	1,168 88		
Disbursements	226 30		
		1,395 18	
Supplies		300 96	
Disbursements		74 22	
			3,589 40
CULLERS' ACT.			
Christie, W. P. .... Disbursements		8 00	
McDougall, J. T. .... Disbursements		11 80	
			19 80
EXPENSES NOT OTHERWISE PROVIDED FOR.			
McKay, A. A., Salary *re* Assistant Inspector of Mines		700 00	
Ellis, W. H., Salary *re* investigating Natural Gas		600 00	
Bartlett, J., Salary *re* Assistant Inspector of Mines		383 33	
Hendricks, G. F., Salary and Disbursements *re* Toronto Exhibition	191 85		
Carried forward	191 85	1,683 33	501,070 23

Appendix No. 6.—Continued.

Service.	$ c.	$ c.	$ c.
Brought forward	191 85	1,683 33	501,070 23
Expenses Not Otherwise Provided For.—*Concluded.*			
Brophy, W. H., Salary *re* Toronto Exhibition	49 50		
West, Walter, Salary *re* Toronto Exhibition	50 00		
Flannigan, F., Salary *re* Toronto Exhibition	6 75		
Byam, F., Salary *re* Toronto Exhibition	13 50		
Rothwell, T. E., Disbursements *re* Toronto Exhibition	9 30		
McNeill, W. K., Disbursements *re* Toronto Exhibition	30 80		
		351 70	
General Disbursements *re* Toronto Exhibition		561 13	
			2,596 16
Surveys			36,496 20
Board of Surveyors			200 00
Experimental Treatment of Ore			35 00
Refunds—Miscellaneous			16,033 98
Contingencies.			
Departmental.			
Printing and Binding	5,296 52		
Stationery	4,912 54		
		10,209 06	
Postage	1,945 34		
Express	379 62		
		2,324 96	
Telegraphing	695 53		
Car Fare	40 00		
		735 53	
Subscriptions	253 64		
Advertising	13.555 22		
		13,808 86	
Typewriters and repairs		552 80	
Hearst, Hon. W. H., travelling expenses	200 00		
Newman, F. S., travelling expenses	62 80		
Zavitz, E. J., travelling expenses	67 56		
Acres, H. G., services *re* Waterways	313 00		
Hele, C. C., travelling expenses	6 65		
Teskey, J. F., valuating water lots	25 00		
Nesbitt, W., services *re* Petewawa Military Camp	300 00		
White, A., travelling expenses	138 10		
Hutcheon, J., travelling expenses	384 26		
Rorke, L. V., travelling expenses	6 75		
Dalton Company of Canada, Adding Machine	357 50		
		1,861 62	
Extra Clerks	3,859 15		
Sundries	96 50		
		3,955 65	
Bureau of Mines.			33,448 48
Printing and Binding	1,191 49		
Stationery	1.379 09		
		2,570 58	
Carried forward		2,570 58	589,880 05

Appendix No. 6.—Concluded.

Service.	$ c.	$ c.	$ c.
Brought forward		2,570 58	589,880 05
BUREAU OF MINES.—*Concluded.*			
Postage	493 41		
Telegraphing	212 05		
Express and Cartage	63 91		
Advertising	682 10		
Subscriptions	333 53		
Maps	649 02		
		2,434 02	
Gibson, T. W., travelling expenses	194 22		
Typewriters, repairs, etc.	72 50		
		266 72	
Nicholas, F. J., Preparing Index	110 50		
Morris, W. H., Preparing Tax Rolls	68 00		
Lemoine, Wm., Preparing Tax Rolls	68 00		
Sundries	498 47		
		744 97	
FORESTRY.			6,016 29
Zavitz, E. J., travelling expenses	120 35		
Newman, F. S., travelling expenses	174 00		
Madden, G. O., travelling expenses	15 60		
		309 95	
Bald, Miss J., services		263 33	
Postage	25 00		
Supplies	165 43		
Sundries	9 27		
		199 70	
			772 98
			$596,669 32

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 7.

Statement of Expenses on account of various Services under the direction of the Department of Lands, Forests and Mines for the year ending October 31st, 1914.

Service.	$ c.	$ c.	$ c.
Algonquin Park		22,782 76	
Algonquin Park, Extinguishing Squatters' Claims		2,000 00	
			24,782 76
Quetico Provincial Park			11,003 18
Veterans' Commutation			400 00
Northern Development			
The Making of Roads.			
Whitson, J. F., Salary	4,208 33		
Bruce, A. E. D., do	2,303 38		
Stewart, L. D. N., do	2,499 96		
Lang, J. L., do	1,240 00		
Laird, R., do	2,355 55		
Chalmers, D., do	1,494 00		
Robinson, W. J., do	1,120 19		
Moore, J. do	1,450 00		
Mills, W. W., do	1,347 22		
Fraser, J., do	368 00		
Beardall, F. G., do	1,504 79		
Laidlaw, Miss B., do	583 00		
		20,474 42	
Wages	392,754 93		
Contracts	123,112 28		
Supplies	255,101 45		
		770,968 66	
Advancement of Settlement and Colonization.			
Wages	6,445 85		
Supplies	2,589 26		
		9,035 11	
Construction of Hearst Sewer		2,100 00	
			802,578 19
Bounty Act VII., Edward VII., Cap. 14.			
Coniagas Reduction Company		28,527 36	
Deloro Mining Reduction Company		12,274 44	
Standard Smelting and Refining Co.		214 92	
			41,016 72
			$879,780 85

D. GEO. ROSS,
Accountant.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 8.

WOODS AND FORESTS.

Statement of revenue collected during the year ending October 31st, 1914.

	$ c.
Amount of Western collections at Department	1,511,698 09
do Belleville collections "	8,220 71
do Ottawa collections	154,969 13
	1,674,887 93

J. A. G. CROZIER,
Chief Clerk in Charge.

AUBREY WHITE,
Deputy Minister.

Appendix No. 9.

PATENTS BRANCH.

Statement of Patents, etc., issued by the Patents Branch from 1st November, 1913, to 31st October, 1914.

Public Lands (late Crown)	669
" " (late School)	27
" " (late Clergy Reserves)	11
" " (University)	13
Free Grant Lands (Act of 1913)	448
" " " (Act of 1901) (Veterans)	345
Mining Lands	611
Mining Leases	181
" " (University)	1
Crown Leases	38
Licenses of Occupation	21
Temagami Leases	1
Total	2,366

CHARLES S. JONES,
Chief Clerk.

AUBREY WHITE,
Deputy Minister.

Appendix

WOODS AND

Statement of Timber and Amounts accrued from Timber Dues, Ground

QUANTITY AND

Agencies.	Area covered by timber licenses.	Saw logs.			
		Pine.		Other.	
	Square miles.	Pieces.	Feet B.M.	Pieces.	Feet B.M.
Western Timber District	12,502	7,826,551	287,608,122	1,590,369	45,093,416
Belleville Timber District	658¼	157,591	3,522,780	324,294	9,740,027
Ottawa Timber District	4.172¾	1,298,044	71,832,292	605,993	16,409,732
	17,333	9,282,186	362,963,194	2,520,656	71,243,175

General Statement

Agencies.	Cordwood.		Tan Bark.	Railway Ties.	Cedar Posts.	Poles.	Stave Bolts.	Pulpwood.
	Hard.	Soft.						
	Cords.	Cords.	Cords.	Pieces.	Cords.	Pieces.	Cords.	Cords.
Western Timber District	18,630	25,145	3,400	5,369,562	192	8,815	2,451	104,544
Belleville Timber District	500	....	....	8,086	60	601	....	....
Ottawa Timber District	2,006	....	779	62,197	107	8,832	....	....
	21,136	25,145	4,179	5,439,845	359	18,248	2,451	104,544

J. A. G. CROZIER,
Chief Clerk in Charge.

No. 10.

FORESTS.

Rent and Bonus during the year ending 31st October, 1914.

DESCRIPTION OF TIMBER.

Boom and Dimension.				Square Timber.		Piling.		Cedar.
Pine.		Other.		Pine.		Tamarac.		
Pieces.	Feet B.M.	Pieces.	Feet B.M.	Pieces.	Cubic feet.	Pieces	Ft.B.M.	Lineal feet.
145,803	16,759,518	39,153	4,126,519	2,490	114,125	838	75,943	28,225
2,300	321,735	3,782	711,763	....	....	....	....	....
10,335	1,168,080	15,450	1,266,232	....	....	....	....	....
158,438	18,249,333	58,385	6,104,514	2,490	114,125	838	75,943	28,225

of Timber.—Concluded.

Amounts accrued.

Transfer bonus.	Interest.	Trespass.	Timber dues.	Bonus.	Deposits timber sales	Ground rent.	Total.
$ c	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
3,905 00	3,952 33	21,668 42	1,004,034 79	397,237 48	322,975 00	69,457 68	1,823,230 70
180 00	69 62	567 30	14,338 13	875 15	....	4,330 00	20,360 20
245 00	2,493 62	332 60	132,884 31	....	....	29,585 00	165,540 53
4,330 00	6,515 57	22,568 32	1,151,257 23	398,112 63	322,975 00	103,372 68	2,009,131 43

AUBREY WHITE,
Deputy Minister.

Appendix No. 11.

Statement of work done in the Military branch of the Department of Lands, Forests and Mines, during the year 1914.

References for Veteran Patents issued	335
Locations under military certificates	47
Certificates applied in payment of lands	19
Certificates surrendered for commutation money	8
Letters received	5,080
Letters written	4,890
Special letters to agents	650
Special letters to mining recorders	300
Maps and reports supplied to veterans	1,100
Printed forms	850
Copies of Veteran Act supplied	250

H. E. JOHNSTON,
Chief Clerk in Charge.

AUBREY WHITE,
Deputy Minister.

Appendix No. 12.

Statement of the number of Letters received and mailed by the Department in 1911-12, 1912-13 and 1913-14.

Year.	Letters received.					Names indexed.	Orders-in-Council.	Returned letters.	Letters, circulars and reports mailed from Department.
	Sales and Free Grants.	Surveys.	Woods and Forests.	Mines.	Totals.				
1911-12	20,050	10,150	7,700	8,750	50,407	57,000	150	76	63,125
1912-13	27,658	11,775	7,219	8,800	55,452	61,500	150	75	65,280
1913-14	25,023	11,100	8,598	8,200	52,921	59,000	125	60	64,000

FRANK YEIGH,
Registrar,

AUBREY WHITE,
Deputy Minister.

Appendix No. 13.

Statement showing the number of Locatees and of acres located; of purchasers and of acres sold; of lots resumed for non-performance of the settlement duties and of patents issued in Free Grant Townships during the year ending 31st October, 1914.

Township.	District or County.	Agent.	No. of persons located.	No. of acres located.	No. of purchasers.	No. of acres sold.	No. of lots resumed.	No. of patents issued.
Baxter	Muskoka	J. B. Brown, Braeebridge	4	432	4	42	3	8
Brunel	"	" "	....	....	...	....	....	....
Cardwell	"	" "	4	475	...	....	2	2
Chaffey	"	" "	2	101	1	¼	....	2
Draper	"	" "	....	....	...	....	1	1
Franklin	"	" "	2	196	1	¼	2	3
Freeman	"	" "	3	301	...	....	2	1
Macaulay	"	" "	....	....	...	....	....	....
Medora	"	" "	1	195	...	....	....	3
Monck	"	" "	....	....	...	....	....	....
Morrison	"	" "	4	630	2	4	1	5
Muskoka	"	" "	3	297	3	6	3	5
McLean	"	" "	3	404	...	....	3	2
Oakley	"	" "	9	1,293½	...	....	9	5
Ridout	"	" "	1	140	...	....	....	2
Ryde	"	" "	5	721	...	....	5	2
Sherborne	"	" "	1	100	...	....	....	1
Sinclair	"	" "	6	738	1	½	5	1
Stephenson	"	" "	....	....	...	....	....	....
Stisted	"	" "	....	....	...	....	....	2
Watt	"	" "	1	97	...	....	1	3
Wood	"	" "	8	1,286	9	35½	8	10
Burpee	Parry Sound	F. R. Powell, Parry Sound	....	....	2	109	....	1
Carling	"	" "	9	1,387	1	12	5	5
Christie	"	" "	8	983	...	....	4	2
Conger	"	" "	1	200	5	95	....	6
Cowper	"	" "	....	....	1	83	....	7
Foley	"	" "	1	100	1	1	1	2
Ferguson	"	" "	....	....	1	200	....	2
Hagerman	"	" "	4	681	4	34	3	2
Harrison	"	" "	....	....	...	....	....	16
Henvey	"	" "	3	306	...	....	....	3
Humphrey	"	" "	1	200	...	....	2	1
McConkey	"	" "	8	1,057	1	10	1	1
McDougall	"	" "	4	478	1	89	3	2
McKellar	"	" "	....	....	...	....	....	....
McKenzie	"	" "	....	....	...	....	....	2
Monteith	"	" "	4	567	1	67	6	4
Shawanaga	"	" "	....	....	2	25½	1	15
Wilson	"	" "	2	269	...	....	....	2
Chapman	Parry Sound	Dr. J. S. Freeborn, Magnetawan	4	407	...	....	1	4
Croft	"	" "	5	572	...	....	5	....
Ferrie	"	" "	....	....	...	....	....	2
Gurd	"	" "	3	400	1	19	1	4
Lount	"	" "	8	1,100	1	100	4	4
Machar	"	" "	4	600	1	4	2	2
Mills	"	" "	4	600	...	....	2	2

Appendix No. 13.—Continued.

Township.	District or County.	Agent.	No. of persons located.	No. of acres located.	No. of purchasers.	No. of acres sold.	No. of lots resumed.	No. of patents issued.
Pringle	Parry Sound	Dr. J. S. Freeborn, Magnetawan.	8	953	...	....	....	1
Ryerson	"	" "	....	....	...	....	....	3
Spence	"	" " "	....	....	1	13		4
Strong	"	" " "	1	123	...	....	2	1
Armour	Parry Sound	W. Jenkin, Emsdale.	1	95	...	....	1	2
Bethune	"	" "	8	1,189	...	....	5	7
Joly	"	" "	3	500	...	....	4	2
McMurrich	"	" "	3	282	1	$\frac{1}{2}$	3	5
Perry	"	" "	....	....	...	....	....	3
Proudfoot	"	" "	2	200	1	$\frac{1}{8}$	2	1
Hardy	Parry Sound	H. J. Ellis, Powassan	1	100	...	....	....	2
Himsworth	"	" "	11	1,300	1	11	8	3
Laurier	"	" "	2	227	...	....	3	2
Nipissing	"	" "	3	377	9	288	2	5
Patterson	"	" "	3	400	1	10	2	2
Bonfield	Nipissing	W. J. Parsons, North Bay	12	1,170	2	$12\frac{1}{2}$	4	6
Boulter (pt)	"	" "	....	....	...	....	....	....
Chisholm	"	" "	14	1,684	2	$6\frac{1}{2}$	12	10
Ferris	"	" "	28	2,783	2	35	20	15
Anson	Haliburton	R. H. Baker, Minden	1	100	...	....	1	1
Glamorgan	"	" "	5	466	...	....	5	4
Hindon	"	" "	....	....	...	....	....	....
Lutterworth	"	" "	5	557	...	....	2	2
Minden	"	" "	4	372	...	....	3	4
Snowdon	"	" "	10	1,207	...	....	8	....
Stanhope	"	" "	4	477	...	....	4	1
Anstruther	Peterboro'.	William Hales, Apsley	2	200	...	....	2	2
Burleigh, N.D.	"	" "	....	....	...	....	....	....
" S.D.	"	" "	....	....	...	....	....	....
Chandos	"	" "	1	62	...	....	....	1
Methuen	"	" "	....	....	...	....	....	....
Cardiff	Haliburton	James Wilson, Kinmount	7	891	...	....	8	2
Cavendish	Peterboro'	" "	1	88	1	5	....	3
Galway	"	" "	13	1,472	1	97	[illegible]	2
Monmouth	Haliburton	" "	7	748	1	94	[illegible]	4
Bangor	Hastings	W. J. Douglas, Greenview	8	800	...	....	5	....
Carlaw	"	" "	2	225	...	....	....	....
Cashel	"	" "	....	....	...	....	....	....
Dungannon	"	" "	5	$440\frac{1}{2}$	...	....	1	5
Faraday	"	" "	5	$669\frac{1}{2}$	1	9	2	3
Herschel	"	" "	12	$1,562\frac{1}{2}$	3	11	[illegible]	7
Limerick	"	" "	3	295	...	....	1	....
Mayo	"	" "	2	173	...	....	1	3
Monteagle	"	" "	13	$1,413\frac{1}{2}$	2	12	[illegible]	6
McClure	"	" "	4	629	1	10	....	1
Wicklow	"	" "	8	890	3	16	[illegible]	1
Wollaston	"	" "	....	....	...	....	....	....
Algona, S.	Renfrew	Adam Prince, Wilno	....	....	...	....	....	1
Brougham	"	" "	6	807	...	....	[illegible]	5

Appendix No. 13.—Continued.

Township.	District or County.	Agent.	No. of persons located.	No. of acres located.	No. of purchasers.	No. of acres sold.	No. of lots resumed.	No. of patents issued.
Brudenell ...	Renfrew	Adam Prince, Wilno........	9	1,097	1	50	5	3
Burns	"	" "	2	197	2	65½	17	3
Grattan	"	" "	3	296	....	....	1	5
Griffith	"	" "	9	942½	....	....	1	2
Hagarty	"	" "	5	576	....	....	5	4
Jones	"	" "	....	....	....	....	....	....
Lyell	Nipissing	" "	2	300	....	....	....	2
Lyndoch	Renfrew	" "	3	306	....	....	1	1
Matawatchan.	"	" "	1	76	....	....	....	....
Radcliffe	"	" "	5	614	....	....	3	1
Raglan	"	" "	9	1,025	....	....	2	9
Richards	"	" "	3	400	1	....	5	4
Sebastopol ..	"	" "	1	60½	....	96	....	1
Sherwood	"	" "	5	435	1	4	4	....
Algona, N....	Renfrew	Finlay Watt Pembroke......	1	199	....	....	....	2
Alice	"	" "	2	199	1	....	2	2
Buchanan (pt	"	" "	1	129	....	....	....	....
Fraser	"	" "	3	420	2	58½	1	4
Head	"	" "	....	....	....	....	....	....
Maria	"	" "	....	....	....	....	....	....
McKay (pt) ..	"	" "	....	....	....	....	....	....
Petawawa ...	"	" "	5	502	1	½	2	....
Rolph	"	" "	5	559	1	100	2	2
Wilberforce ..	"	" "	1	90	....	....	....	....
Wylie (pt)....	"	" "	8	881	....	....	3	1
Calvin	Nipissing	Robert Small, Mattawa.....	2	190	....	....	2	3
Cameron (pt).	"	" "	2	275	....	....	....	1
Lauder	"	" "	....	....	....	....	....	....
Mattawan....	"	" "	1	172	....	....	1	1
Papineau	"	" "	16	1,844	1	208	12	3
Korah	Algoma	Edw'd Noble, Sault Ste. Marie	....	....	....	....	....	....
Parke........	"	" "	....	....	....	....	....	....
Prince	"	" "	3	434	....	....	3	5
Aberdeen	Algoma	Thos. Buchanan, Thessalon.	3	483½	....	....	1	1
" add.	"	" "	....	....	....	....	....	....
Galbraith	"	" "	1	162½	....	....	....	5
Lefroy	"	" "	....	....	....	....	....	....
Plummer	"	" "	1	160	....	....	....	....
" add.	"	" "	....	....	....	....	....	....
St. Joseph Is'd	Algoma	W. E. Whybourne, Marksville	9	894	2	8½	8	3
Baldwin (pt.).	Algoma	Neil Mulvaney, Espanola....	10	1,566	1	3	2	2
Merritt.......	"	" "	8	1,062	....	....	3	7
Blake.... ..	Thunder Bay.	W. A. Burows, Port Arthur.	48	7,283	2	240	21	9
Conmee	"	" "	33	4,883½	1	72½	28	26
Crooks	"	" "	16	2,189	2	31	10	2
Dawson Road.	"	" "	103	10,413	7	192	47	....
Dorion	"	" "	12	1,776½	2	200	7	24
Gillies	"	" "	5	712½	2	151½	4	5
Gorham.......	"	" "	35	5,049	1	460½	29	7
Lybster	"	" "	7	912	4	287	9	5
Marks........	"	" "	11	1,568½	....	....	7	4

Appendix No. 13.—Continued.

Township.	District or County.	Agent.	No. of persons located.	No. of acres located.	No. of purchasers.	No. of acres sold.	No. of lots resumed.	No. of patents issued.
McGregor	Thunder Bay.	W. A. Burows, Port Arthur.	20	3,202	5	198	22	7
McIntyre ...	"	" "	1	72	...	....	....	4
O'Connor.. .	"	" "	3	445½	2	3½	3	6
Oliver........	"	" "	2	308¾	4	191	1	8
Paipoonge, N R	"	" "	....	....	...	....	....	2
" S R	"	" "	7	878	...	....	8	6
Pardee......	"	" "	3	640	...	....	1	3
Pearson.......	"	" "	69	11,252½	4	119¼	27	2
Scoble.........	"	" "	36	5,519½	4	43	27	5
Stirling.......	"	" "	87	13,194	1	80	12	....
Strange......	"	" "	10	1,691½	...	....	9	3
Ware	"	" "	76	11,474½	7	289½	59	18
Atwood .. .	Rainy River.	William Cameron, Stratton..	....	....	1	1	....	1
Blue	"	" "	11	1,208½	3	7	2	5
Curran..... .	"	" "	6	888	1	4	5	2
Dewart	"	" "	19	3,116	4	84¾	5	1
Dilke	"	" "	1	125	1	2	1	1
Morley.......	"	" "	10	1,378	4	10	9	3
Morson	"	" "	63	7,151¾	9	461	47	4
McCrosson ...	"	" "	13	1,651	7	366¾	10	4
Nelles.........	"	" "	12	1,569½	4	10	13	4
Pattullo... ..	"	" "	16	1,583	4	88	9	6
Pratt	"	" "	6	997	3	160	4	2
Rosebery	"	" "	....	....	...	....	....	....
Shenston......	"	" "	3	382	5	58	3	7
Sifton	"	" "	25	3,617¼	10	439	20	4
Spohn	"	" "	38	5,777	5	10	29	....
Sutherland ...	"	" "	22	3,462½	4	132½	16	1
Tait	"	" "	12	1,710	8	169½	7	7
Tovell ..	"	" "	20	2,749½	3	105	8	2
Worthington..	"	" "	2	200½	1	4	2	1
Aylsworth ...	Rainy River .	Alex. McFayden, Emo	1	40½	...	....	....	....
Barwick	"	" "	....	....	...	....	....	1
Burriss	"	" "	7	1,092	5	117	7	11
Carpenter	"	" "	4	620	2	177	3	4
Crozier.......	"	" "	5	740	2	120	7	2
Dance.........	"	" "	20	3,178	2	20	19	1
Devlin	"	" "	1	162	2	4	2	4
Dobie	"	" "	6	912	3	105½	4	5
Fleming	"	" "	....	....	...	....	....	....
Kingsford . ..	"	" "	10	1,566½	4	109¼	10	2
Lash.........	"	" "	3	447½	2	6	3	3
Mather	"	" "	11	1,742	1	16	8	3
Miscampbell .	"	" "	11	1,738	4	199½	12	4
Potts	"	" "	18	2,765½	2	81½	16	6
Richardson...	"	" "	16	2,385¼	...	....	13	11
Roddick......	"	" "	....	....	...	....	....	....
Woodyatt	"	" "	....	....	...	....	....	....
Aubrey	Kenora	R. H. Pronger, Dryden	8	997½	1	71½	4	8
Britton	"	" "	17	2,725	...	....	1	3
Eton.........	"	" "	15	2,270¼	...	....	8	6
Langton	"	" "	8	1,246½	...	....	4	....
Melgund	"	" "	5	774	1	7⅓	5	1
Mutrie.......	"	" "	8	1,215	1	1	11	4
Rowell	"	" "	5	720	...	....	....	....
Rugby	"	" "	3	480½	1	52	1	3

Appendix No. 13.—Concluded.

Township.	District or County.	Agent.	No. of persons located.	No of acres located.	No. of purchasers.	No. of acres sold.	No. of lots resumed.	No. of patents issued.
Sanford	Kenora	R. H. Pronger, Dryden	21	3,191	1	41	13	2
Southworth	"	" "	12	1,867½	1	76	9	2
Temple	"	" "	7	1,138	....	....	5	....
Van Horne	"	" "	10	1,352¾	....	....	6	9
Wabigoon	"	" "	47	7,345¾	5	251¾	33	2
Wainwright	"	" "	12	1,755½	....	....	11	2
Zealand	"	" "	45	6,638	1	16	7	6
Melick	Kenora	W. L. Spry, Kenora	13	1,658	2	34	9	7
Pellatt	"	" "	11	1,381½	2	81	8	6
Blezard	Sudbury	J. A. Lemieux, Blezard Valley	2	317½	3	1½	3	5
Capreol	"	" "	10	1,157½	3	88	2	5
Hanmer	"	" "	4	519	....	....	2	1
Lumsden	"	" "	4	636½	....	....	....	1
Balfour	Sudbury	J. K. MacLennan, Sudbury	4	560	....	....	....	6
Broder	"	" "	22	3,069½	2	....	11	1
Chapleau	"	" "	....	....	6	1,630	....	1
Dill	"	" "	5	786½	1	11½	....	3
Garson	"	" "	7	1,007¾	1	9¼	2	1
Morgan (pt)	"	" "	4	557	1	1½	1	2
Neelon	"	" "	1	163½	1	¼	2	3
Rayside	"	" "	4	438½	1	43½	....	3
Appelby	Sudbury	Emile Langlois, Warren	6	981½	2	13½	1	3
Casimir	"	" "	5	760	2	127½	1	5
Dunnet	"	" "	1	165	1	5	....	1
Hagar	"	" "	9	1,437½	....	....	1	3
Jennings	"	" "	6	949	....	....	....	2
Kirkpatrick	Nipissing	" "	4	641½	2	10½	....	3
Ratter	Sudbury	" "	6	872½	1	6	4	2
Caldwell	Nipissing	J. A. Philion, Sturgeon Falls.	2	230	....	....	....	3
Cosby	Sudbury	" "	10	1,425½	2	4	2	7
Grant	Nipissing	" "	10	1,380½	....	....	1	2
Macpherson	"	" "	6	876½	....	....	....	5
Martland	Sudbury	" "	11	1,739	....	....	5	4
Springer	Nipissing	" "	2	456	1	80	1	5
Abinger	Lennox and Addington	Charles Both, Denbigh	....	....	....	....	....	....
Canonto, S.	Frontenac	" "	1	88	....	....	....	....
" N.	"	" "	....	....	....	....	....	....
Clarendon	"	" "	1	97	....	....	1	2
Denbigh	Lennox and Addington	" "	3	600	1	2	6	2
Miller (pt.)	Frontenac	" "	....	....	....	....	1	1
Palmerston (pt.)	"	" "	....	....	....	....	....	1
McClintock	Muskoka	Unattached	1	100	3	15½	....	3
Airy	Nipissing	"	3	291	2	81	....	1
Finlayson	"	"	....	....	1	10	....	1
Murchison	"	"	2	407	1	7	....	1
Sabine	"	"	6	693	2	300	3	1
			1882	258,371	301	10,867⅞	1125	767

W. C. CAIN, Clerk in Charge.

AUBREY WHITE, Deputy Minister.

Appendix No. 14.

Statement of Municipal Surveys for which instructions issued during the 12 months ending October 31st, 1914.

No.	Name of Surveyor.	No.	Date of Instructions.	Description of Survey.
1	McKay, McKay & Webster.	689	Mar. 3rd, 1914	To survey the boundaries or limits of certain parts of the following public highways in the town of Oakville, namely, Dundas Street, from the northwest limit of Sumner Street to the southeasterly limit of the right of way lands of the Grand Trunk Railway Company, and the "6th line road," from the westerly limit of Dundas Street aforesaid to the said right of way lands of the Grand Trunk Railway Company, and to fix the boundaries or limits thereof by durable monuments, to mark the proper lines of the above streets and roads
2	E. G. Barrow. J. J. McKay.. E. G. McKay..	690	Mar. 20th, 1914	To define the limits of Burlington Street in the City of Hamilton by durable monuments planted at the intersections of the base line or Burlington Street with James Street, Hughson Street, John Street, Catharine Street, Mary Street and Ferguson Avenue.
3	E. R. Bingham	691	Apr. 7th, 1914	To survey certain streets in the City of Port Arthur in the District of Thunder Bay, including North and South Water Streets, Cumberland Street, Court Street, and Algoma Street and all intersecting streets between John Street and McVicar Street, and to have the corners of the streets marked by iron bars duly planted thereat.
4	A. S. Campbell	692	Apr. 9th, 1914	To survey the road allowance between the 3rd and 4th concessions south of the base line in the Township of Wolfe Island in the County of Frontenac, across lots 8, 9 and 10, or as much further on either side as may be necessary to find an original post and to plant durable monuments at the angles of the above lots.
5	Speight & Van Nostrand ..	693	May 20th, 1914	To survey part of the town plot of Port Credit in the County of Peel, lying southwest of the River Credit and northeast of Joseph Street in the said village, and to plant stone or other durable monuments at the front and rear angles of the blocks lying in that part of the village, as shown on annexed plan, pursuant to the provisions of the Surveys Act.
6	W. J. Moore..	694	July 24th, 1914	To survey the road allowance between concessions two and three, in the Township of Ross, from the proof line between lots ten and eleven southeasterly to Olmstead Lake, and to mark said road allowance by permanent monuments.

GEORGE B. KIRKPATRICK,
Director of Surveys.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 15.

Statement of Municipal Surveys confirmed during the 12 months ending October 31st, 1914.

No.	Name of Surveyor.	No.	Date of Instructions.	Description of Survey.	Date when confirmed under R.S.O. 1897, Chap. 181, secs. 10-15, inclusive
1	Thomas H. Dunn	681	Oct. 26th, 1910	To survey the boundary road allowance between the townships of Osnabruck and Cornwall and to have the said boundary marked by permanent stone or iron monuments at the expense of the municipality of the township of Osnabruck, in the County of Stormont.	July 31, 1914
2	McKay, McKay & Webster	689	Mar. 3rd. 1914	To survey the boundaries or limits of certain parts of the following public highways in the town of Oakville, namely, Dundas Street from the northwest limit of Sumner Street to the southeasterly limit of the right of way lands of the Grand Trunk Railway Co., and the "6th line road" from the westerly limit of Dundas Street aforesaid to the said right of way lands of the Grand Trunk Railway Co., and to fix the boundaries or limits thereof by durable monuments, to mark the proper lines of the above streets and roads.	July 4, 1914
3	E. G. Barrow.... J. J. McKay..... E. G. McKay.....	690	Mar. 20th, 1914	To define the limits of Burlington Street in the City of Hamilton by durable monuments planted at the intersections of the base line or Burlington Street with James Street, Hughson Street, John Street, Catharine Street, Mary Street and Ferguson Avenue.	Oct. 15, 1914

GEORGE B. KIRKPATRICK,
Director of Surveys.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 16.

Statement of Crown Surveys in progress during the 12 months ending October 31st, 1914.

No.	Date of Instructions.	Name of Surveyor.	Description of Survey.	Amount Paid.
				$ c.
1	Oct. 15, 1914.	E. R. Bingham....	Subdivision of the Township of Upsala, in the District of Thunder Bay	2,000 00
2	July 8, 1914.	E. R. Bingham....	Subdivision of part of the Township of Fraleigh, in the District of Thunder Bay	
3	July 28, 1914.	Phillips & Benner.	Subdivision of the Township of Jacques. in the District of Thunder Bay	3,000 00
4	July 22, 1914.	A. McMeekin......	Subdivision of the Township of Redvers, in the District of Kenora..............................	1,500 00
				6,500 00

GEORGE B. KIRKPATRICK,
Director of Surveys.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 17.

Statement of Crown Surveys, completed and closed during the 12 months ending October 31st, 1914.

No.	Date of Instructions.	Name of Surveyor.	Description of Survey.	Amount paid. $ c	No. of Acres.
1	July 4, 1912	Patterson & Byrne	Survey of Township of Drayton, District of Kenora	2,550 75	52,792
2	July 4, 1912	Patterson & Byrne	Survey of part of Township of Mattawan, District of Nipissing.	1,052 60	2,016
3	July 15, 1913	J. R. Allen	Survey of Township of Stirling, District of Thunder Bay	946 55	22,945
4	July 7, 1913	David Beatty	Survey of Township of Lowther, District of Algoma	77 45	51,860
5	June 30, 1913	H. J. Beatty	Survey of Township of Schofield, District of Algoma	1,742 76	62,559
6	July 10, 1913	J. K. Benner	Survey of timber berths in the District of Thunder Bay	504 75	
7	July 19, 1913	J. S. Dobie	Survey of township outlines, Districts of Sudbury and Algoma.	1,641 85	
8	July 2, 1913	J. W. Fitzgerald	Survey of Township of Caithness, District of Algoma	1.197 46	57,570
9	July 4, 1913	C. H. Fullerton	Survey of Township of O'Brien, District of Timiskaming	1,669 06	51,970
10	July 3, 1913	J. R. Gill	Survey of Township of Talbot, District of Algoma	1,409 10	52,364
11	June 30, 1913	Lang & Ross	Survey of Township of Orkney, District of Algoma	1,154 80	57,893
12	July 9, 1913	T. J. Patten	Survey of Township of Shetland, District of Algoma	2,005 24	52,732
13	July 12, 1913	Speight & Van Nostrand	Survey of Township of Ebbs, District of Algoma	2,756 12	62,760
14	July 19, 1913 and Aug. 14, 1913	Sutcliffe & Neelands Sutcliffe & Neelands	Survey of outlines of townships, District of Kenora Survey of Township of Malachi, District of Kenora	2,576 80	23,054
15	Apr. 18, 1913	A. L. Russell	Survey of land adjoining and north of Townships of Ware, Gorham and McGregor, District of Thunder Bay	2,993 47	16,881
16	July 17, 1913	McAuslan & Anderson	Survey outlines, District of Kenora	1,565 40	
17	Mar. 15, 1913	E. Seager	Survey of Timber Berth K. 11, District of Kenora	204 95	
18	July 30, 1914	E. Seager	Survey of Timber Berths K. 28, 29 and 30, District of Kenora	895 70	
19	Feb. 14, 1914	W. Smith	Survey of fallen timber at Burwash Lake, District of Sudbury.	484 29	
20	Mar. 12, 1914	F. C. Lane	Survey of fallen timber at Burwash Lake, District of Sudbury.	428 30	
21	Mar. 10, 1914	J. S. Dobie	Survey of Timber Berth A., Mississaga Forest Reserve, District of Algoma	408 85	
22	July 23, 1914	C. H. Fullerton	Survey of water power on Blanche River, District of Timiskaming.	197 70	
23		Jas. Hutcheon	Examination of land in rear of Hastings Road and water power on Victoria Creek near Larder Lake	43 30	
			Rice Lewis & Son, iron posts	190 00	
			Capt. J. White, examination sand and gravel, Pelee Island	22 60	
			C. Tarling, mounting maps	26 35	
			E. H. Harcourt & Co., lithographing	1,250 00	
				29,996 20	567,396

GEORGE B. KIRKPATRICK,
Director of Surveys.

AUBREY WHITE,
Deputy Minister of Lands and Forests.

Appendix No. 18.

SURVEY OF TOWNSHIP OUTLINES IN THE DISTRICTS OF ALGOMA AND SUDBURY.

THESSALON, Ontario, November 22nd, 1913.

SIR,—In accordance with your instructions dated July 19th, 1913, I have made a survey of certain township outlines in the districts of Algoma and Sudbury, and beg to submit the following report.

The starting point for this survey was the north-east corner of township 7 D, the north boundary of which was run by myself in the year 1910. From this point a base line was run due east on six mile chords of a parallel of latitude, to intersect the meridian line run by O.L.S. Niven in 1902, at a point 4.49 chains south of the 30th mile post. A meridian line run by O.L.S. Patten in 1910, was intersected at a point 6 miles 1.40 chains east of my original starting point. From this point, which is the north-east corner of township 7 C, a meridian line was run north a distance of six miles. From the end of each succeeding six mile chord, a meridian line was run both north and south, a distance of six miles, more or less. The meridian lines running south were run as far as the intersection with the base line run by O.L.S. Niven in 1902. The meridian lines running north were intersected by a base line run by myself later in the season. The meridian line running north between township 8 A and 8 Z, was run a distance of six miles, and from the end of this meridian, a base line was run east a distance of 5 miles, 57.58 chains, to intersect the meridian line run by O.L.S. Niven in 1902, at a point 4.05 chains south of the 36 mile post. The same base line was run west on a series of six mile chords, to intersect the meridian line run by O.L.S. Patten in 1910, at a point 30 links north of the six mile post. This base line intersects the meridian lines previously described.

At each of the township corners formed by the intersection of these base and meridian lines, an iron post was planted, and marked with the numbers of the adjoining townships. At the end of every third mile on both base and meridian lines, a similar iron post was planted, and marked IIIM on the south side in the case of a meridian line, and on the east side in the case of a base line. Wooden posts of the best timber available were planted alongside these iron posts and similarly marked. Wooden posts were planted at the end of each mile, and when the end of a mile came in the water, the post was planted on the nearest shore, and the chainage was marked upon it. The end of each half mile was also marked by a wooden post with the chainage carved upon it. The posts were all marked on the south side in the case of a meridian line, and on the east side in the case of a base line. Bearing trees were marked wherever possible, and the distance and bearing of of the bearing tree from the post recorded in the proper place in the field notes. Mounds of stone were erected around the posts wherever it was possible to obtain them.

The lines were all run with a transit, and observations for azimuth were taken every clear day on the line. For this purpose a Waltham sidereal watch was carried, and checked at frequent intervals. The transit used on this work has an object glass sufficiently powerful to permit of observations being taken on Polaris in the daytime. The results of the observations are entered in their proper places in the field notes.

The lines are all well cut out and blazed, and every care was taken to see that the survey was performed in a proper manner.

General Characteristics.

The territory embraced within the limits of this survey as a whole, is rough and hilly. It is considerably broken with rock ridges, and with hills of gravel and boulders of glacial origin. As a whole, however, the country is not as rough as that a few miles further south, the rock ridges not being so high nor so numerous. The amount of land suitable for agriculture is very small. There are a few small areas of sandy loam, but these are isolated, and so scattered that nowhere within the limits of the area surveyed would it be possible to develop an agricultural industry.

Timber.

These townships as a whole are well timbered with a mixed growth of the timber characteristic of this country. There is very little red or white pine, and what there is occurs in scattered trees throughout the other timber. The best white pine encountered is in townships 7 Z and 8 Z. There are a few scattered trees near the west boundary of townships 7 C and 8 C, but in comparison with the large area embraced within the area surveyed, the amount of red and white pine is very small. The most valuable timber is jack pine and spruce. The amount of jack pine is very large, and the timber is of splendid quality. The trees in many places grow very thickly, and are large and straight. Some of the best tie timber I have ever seen is to be found within the limits of these townships. There is also a large quantity of very good spruce. There are very few large spruce swamps, the best spruce being found on the higher ground, growing amongst other timber. The remaining timber on the unburnt areas, is a mixed growth of balsam, white birch, poplar, etc. Fire has done a great deal of damage in this section of the country, and every township has suffered to a greater or less extent. It is noticeable that the fires for the most part seem to have occurred along the canoe routes, and some of them have run for long distances. Some of these fires have occurred many years ago, and the second growth is now grown up to a considerable size, although it is very noticeable that the second growth timber is nowhere of as good quality as that which grows on the portions which have escaped the fire. Other fires have been of more recent origin. One large fire has over-run a considerable area in townships 8 A and 8 Z not very long ago, as the timber is not yet all fallen, and the second growth is still very small.

Water.

The territory lying within the limits of this survey is well watered with numerous small lakes and streams. It is practically all drained by the various tributaries of the Mississauga river, only a small area at the extreme east end of this territory being tributary to the Spanish river. The Wenebegon river, which has an average width of about one chain, runs through townships 7 C and 8 C. The Kebsquasheshing river, which forms part of the canoe route to the Wenebegon river from the main line of the Canadian Pacific Railway empties into the Wenebegon river in township 8 C. The Embrass river joins the Wenebegon river in township 7 C, and drains a number of lakes, some of which are fairly large. In townships 8 A, 8 Z and 7 Z, there are a number of lakes of considerable size, the waters of which flow to the Mississauga river, probably by way of White Owl lake. There is a canoe route via these lakes from the fire ranger's headquarters at Green lake to the Wenebegon river. This route is much used by the fire rangers, and the portages are all well cut out. The portages are very numerous, however,

and during the time that this survey was in progress, the water in the creeks connecting these lakes was very shallow. In several cases it was necessary to cut out new portages around these creeks, as there was not enough water to float a loaded canoe. Most of these creeks could be used for driving timber, with some improvements, as an abundant supply of water for this purpose could be stored in the various lakes.

Water Powers.

The water powers are not of great importance in this section, as this territory is fairly close to the head waters of the streams flowing through it. There is one fall on the Wenebegon river in township 7 C, where the river drops about 30 feet in 25 chains, and a dam could easily be erected which would considerably increase the head. Wenebegon lake would make a splendid storage reservoir. This is the only power of any importance that could be developed in this territory. There are other small falls, but they are relatively unimportant.

Minerals.

The prevailing geological formation is Laurentian. The rock exposures are nearly all granite, in some cases with very coarse crystals of feldspar. The granite is intersected in many places with dikes of fine grained trap. In most cases the contact of these dikes with the granite is so tight that the adjoining rocks are almost fused together. No minerals of any economic value were observed during the progress of the survey.

Fish and Game.

Most of the lakes within the limits of the survey are well supplied with fish. The net which was supplied by your Department was set whenever it was possible, although more fish were caught with a troll than with the net. All the lakes where fishing was tried contain pike. Embrass lake and the large lake through which the north boundary of township 7 Z passes, contain whitefish and suckers. The whitefish caught by us, however, were small and of poor quality. Marion lake and the large lake in the south-west corner of township 8 Z are said by the Indians to contain lake trout, but we were not successful in catching any. Moose are very plentiful, and a few deer were seen; also some traces of bear. The ordinary small fur-bearing animals appear to be quite plentiful, and beaver are becoming very numerous. The ordinary ruffed grouse, or partridge have shown an extraordinary increase in numbers during the last few years, and are now very plentiful.

The magnetic variation is fairly constant at an average value of about 4 degrees 30 minutes.

Herewith are included field notes, a plan on mounted drawing paper, a timber plan on tracing linen, and accounts in triplicate, all properly attested.

I have the honour to be, Sir,

Your obedient servant,

(Signed) James S. Dobie,

Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ontario.

Appendix No. 19.

Survey of Township Outlines in the District of Kenora.

North Bay, Ont., September 24th, 1913.

Sir,—We beg to advise the completion of the survey of certain township outlines performed under instructions from your Department bearing date of July 17th, 1913, and to submit thereon the following report:

The survey was commenced, according to the instructions, at the iron post marking the north west angle of Rowell township, from which point No. 2 base line was run west astronomically on 6 mile chords a distance of twenty-four miles. From the 6 mile post on this base line, our No. 1 meridian was run south astronomically to Rosamond lake, and triangulated connections were there made with the posts planted by O.L.S. MacDougall in the survey of the township of Rugby, to mark the extremities of the west and north boundaries of that township. We find, that had these two lines been produced, they would have intersected on the mainland, instead of in Rosamond lake as was shown on Ruby township plan. These triangulations are reduced and the connections illustrated in the field notes.

No. 2 meridian was run south astronomically from the 12 mile post on No. 2 base line, to the intersection with the north boundary of the township of Mutrie. From the 6 mile post on this meridian No. 1 base line was run east astronomically on a six mile chord to an intersection with No. 1 meridian, and run west astronomically in a similar manner to an intersection with No. 3 meridian.

From the 18 mile post on No. 2 base line our No. 3 meridian was run south astronomically to an intersection with the north boundary of Wabigoon township; and from the 24 mile post on No. 2 base line, which point occurs on an island in Clay lake, our No. 4 meridian was run south astronomically to an intersection with the north boundary of Smellie township.

Iron posts, properly marked with a cold chisel, were planted at intervals of 3 miles along our lines, while 6 inch posts of spruce or jack pine at intervals of 1 mile; and 4 inch posts of spruce or jack pine at intervals of half a mile were suitably scribed and planted. Wherever possible these posts were mounded with stones and bearing trees marked and noted. Some few extra posts were planted at irregular chainages, to mark the intersection of our lines with shore lines the same being properly recorded in the notes. Frequent astronomic observations for azimuth were taken and are recorded in the notes, numerous magnetic observations were also made from which latter the magnetic variation was found to average N. 10 degrees E.

General Features.

A very large percentage of the area embraced by this survey is very barren, rough and rocky, and almost the entire area has been fire swept. In the first instance this has very probably occurred during the construction of the Canadian Pacific Railway and again about six years or so ago. Much of the timber as a result of this former fire has fallen down and is a tangle, thickly up grown with small young jack pine. Small areas of clay of a high quality are mingled with these mountains, but so restricted in area, and so scattered, as to raise the question as to whether community farming would be practicable, excepting in those areas lying adjacent to the Grand Trunk Pacific Railway. Again, restricted areas of good jack pine of a fair size coupled with unrestricted areas of thicket growth of small

jack pine make the question of setting aside this area for a timber reserve worthy of consideration. Clay lake occupies a large area of the north-west corner of the township of Redvers, and a laige number of islands occur in this lake within the limits of this township. Along this lake and the Wabigoon river there is a wide deposit of good soil and this township, particularly the south-westerly and westerly portions of it, forms a very favorable proposition for subdivision.

Soil.

The soil is in most cases of a clay loam, very little of heavy white clay being encountered. Again our lines crossed many small sandy flats scattered among the mountains. The clay is of a light loam, and from evidences seen, of a high order of productiveness.

Timber.

As before mentioned jack pine is the predominating timber, the vast majority of it being at present too small for commercial purposes. There are, however, small areas of it sufficiently large in dimensions to be used for railway purposes. In the swamps are spruce of suitable dimensions for pulp wood while in a few instances Norway pine of a fair dimension were encountered, but these are a negligible quantity.

Rock.

The country rock is red granite showing abundant evidences of past glacial action. No contacts were observed, nor economic minerals encountered.

Lakes.

Many lakes were encountered, small in area but all stocked with fish, the chief varieties being pike, pickerel and maskalonge. Unfortunately through the carelessness of the express company's officials at Sioux Lookout we did not get the net sent in to us by the Game Wardens' Department until too late for us to make use of. The varieties enumerated were caught by hand lines.

Game.

Large game is very plentiful and moose, caribou, red deer and bear were seen daily during the progress of the work. Small fur is also very abundant and trapping is reported to be quite profitable.

Accompanying this report are plan, field notes, accounts in triplicate, etc., all of which are respectfully submitted for your approval.

We have the honour to be, Sir,

Your obedient servants,

(Signed) McAuslan & Anderson,

Ontario Land Surveyors.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ontario.

Appendix No. 20.

Survey of Township Outlines of Pelican, Malachi and Rice, in the District of Kenora.

New Liskeard, Ontario, March 11th, 1914.

Sir,—In compliance with your instructions bearing date of July 19th, 1913, I proceeded to Kenora where provisions and three canoes were purchased, and the following day started down the Winnipeg river. Through the kindness of Mr. Frazer, Government Road foreman, I was able to get part of our supplies and men taken to Smith's farm by gasolene launch. From this point our supplies were portaged to Culloden lake and thence by canoe to west end of same, which was within ten chains of starting point.

The first night an observation was obtained, and the following day while supplies were being brought up and everything gotten in shape for action I scouted the country west of this point for four or five miles and discovered the portages and canoe route which was very convenient to our work. After cutting two miles, I moved camp and supplies to Catharine lake, from which place the cook and one or two men moved everything by canoe for almost the entire survey; while, with four men on line and my assistant and one chainer following, we ran west ten and a half miles. I then moved north along Pelican Pouch lake, carrying along first meridian. From our camp at north end of Pelican Pouch lake I took fly camp via timber road most of the way to Long lake, fortunately striking it at the most westerly point about five chains from where the second base line afterwards crossed. I immediately had one canoe brought ahead and the same night my assistant, picket man, and I camped at the north-west angle of Umbach township where an observation was obtained, and the following day we ran 2nd base line to Long lake, and thence on to Otter where we discovered that a canoe route led around to the north of our line to Long lake. I doubt, however, if we could have gained any time by using same.

When I closed in the first township, i.e., Pelican, I found that my angle at the north-west angle of same was theoretically correct, but found the chainage three chains and forty-eight links shorter than south boundary of Pelican. After checking over all the triangulation and finding no error—the chainers taking particular care in trying to see how close we could close—we decided that the error might possibly be in the west boundary of Umbach, and accordingly, started chainage again from north west corner of Pelican, thinking that position of posts might be confusing if subdividing to the north in the future. The one-half mile posts were afterwards removed on advice from Mr. L. V. Rorke, for same reason.

The second base line was run ahead to North Scott lake and left until we moved to south end of Malachi lake, from which point the 1st base line was picked up and run out to end of twelve miles. We then ran second meridian north to 2nd base line, closing 80 links west of 6 mile post and 14 links long on second meridian. I discovered the following night that the 2nd base line at this point was running 3 minutes north of the theoretical bearing, checking with chainage of 2nd meridian. Accordingly, I decided to run line straight ahead as it was then running within 1½ minutes of bearing for last six mile chord.

My assistant then started traverse of Malachi lake, first making triangulation survey of same and later connecting points of traverse by detailed traverse of shore line, while with a fly camp I finished 1st base line, hitting eight chains and

seventy links north of 30th mile post on Manitoba boundary, the south boundary of Rice being five miles, sixty-five chains and eighty-seven links. Returning I moved camp to north end of Malachi lake where canoe route was used via North, Scott, and Moose lakes in finishing 2nd base line, hitting Manitoba boundary nine chains and seventy links north of 36th mile post; the chainage of north boundary of Rice being five miles, sixty-four chains and eighty-four links.

I do not consider it wise to subdivide the remaining townships, as a very small percentage of the land is good. Where patches do occur, the soil is generally very fertile and the timber large, but the country for the most part is bare rock or sand, or rock with a very light overburden.

Pelican Township.

Practically the whole south boundary of Pelican township ran through small second growth poplar and jack pine; bare rock being visible much of the distance. At the south east angle of the township there was a small area of good agricultural land, and another small strip where the Government Road passes through. The north boundary runs through heavier timber, which the fire has not passed through. There is a fairly good section of land lying between Long lake and Trout lake. Another small section of land along the west boundary of Pelican between Malachi township and Pelican Pouch lake is arable in spots, particularly the northern part.

I covered most of the southern, northern and western, and eastern sections of this township, but there is six or eight square miles in the centre that I was not through.

Along the eastern side of the southern part of Pelican Pouch lake the land is fairly regular with a fairly heavy overburden of sand, on which grows fairly large jack pine.

The Government Road through Pelican township, I firmly believe passes through by far the best part of it.

Malachi Township.

Malachi township has considerable good timber, much of which, however, has been removed, but there still remains much good jack pine, especially along the western and southern sides of Malachi lake, and south of Duck lake across the south boundary; in other words, that section of the township south-west of a line from Muddy lake on the south to Malachi station.

East and north-east of Duck lake at least one and a half square miles is bare rock, on which scarcely anything but blueberries grow; these, however, are very plentiful and tons are shipped yearly from this spot.

The remainder of the township is covered for the most part with small jack pine and poplar.

This township, like Pelican, has a small percentage of good clay land.

Rice Township.

Rice township in some respects is similar to Pelican. The south boundary from M.14 to the boundary, running through light timber and over bare rock. The eastern section has some very good timber, and also, the northern—with the exception of the last two miles near the Manitoba boundary, which is light.

I found, in a general way, the best timber and the best land adjacent to the large lakes.

There is possibly from five to ten per cent. clay soil; from twenty to thirty, sandy soil with rock outcroppings; and the remainder bare rock, or barely covered.

Fruit.

We found wild plums and blueberries in considerable quantities, and raspberries occasionally, but fruit should be a pretty fair crop.

Game.

Moose, red deer, and caribou are plentiful, as well as porcupine and rabbits. We saw several mink and muskrats, but no recent trace of beaver. Coyotes seemed fairly plentiful but we only heard them.

Fish.

According to your instructions, we set the net whenever and wherever possible, but Malachi lake seemed the only lake in which we were successful. Large pike and pickerel seem quite abundant, and the Indians say white fish, too, are plentiful, but rather difficult to catch during the summer months.

In Pelican Pouch lake we caught only suckers and these seemed plentiful.

The water in this lake is very clear but becomes covered with a green scum at least one-half inch in thickness during August and September.

In Clear lake and Trout lake we saw dead trout lying on the shore.

We used the troll on Catharine and Otter lakes but with little success.

Rock Formation.

We examined this carefully along all the lines and found nothing but Laurentian granite. In the southern part of Pelican township it was of a reddish color, containing much feldspar and large veins of smoky quartz, but of a very hungry and glassy nature.

The formation to the north and particularly along the Grand Trunk Pacific Railway, was somewhat grey in color and appeared to break readily along horizontal seams.

We carefully noted all rock met with and found no trace of economic minerals.

Accompanying this report, please find plan on mounted paper, and timber plan. We are sending in traverse of Malachi lake on mounted paper as well as on tracing linen, with plan of subdivision of Malachi township—the second contract.

Trusting that our returns meet with your approval.

We have the honour to be, Sir,

Your obedient servants,

(Signed) Sutcliffe & Neelands,
Ontario Land Surveyors.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ontario.

Appendix No. 21

Survey of the Township of Caithness, District of Algoma.

Peterborough, December 29th, 1913.

Sir,—I have the honour to report the completion of the survey of the township of Caithness in the District of Algoma performed under instructions from your Department dated July 2nd of this year. I beg to submit also the field notes and plan of the township all of which I trust will be found complete and satisfactory.

As instructed I commenced the survey proper at the south-east angle of the township, from this point I chained westerly along the south boundary, giving to each of the lots a width of twenty-five chains and twenty-five links from lot one to thirty, inclusive. Lot thirty-one being thirty-seven chains and eighty-seven links. A half road allowance of fifty links was allowed for east of lot one and a full road allowance of one chain between lots six and seven, twelve and thirteen, eighteen and nineteen, and twenty-four and twenty-five, a half road allowance was also allowed for along the east side of the west boundary, the side lines in the centre of the road allowances between lots six and seven, twelve and thirteen, eighteen and nineteen and twenty-four and twenty-five. I ran due north astronomically from the south to the north boundary of the township. To each of the regular concessions I gave a depth of fifty-nine chains and fifty links, leaving a road allowance of one chain between concession two and three, four and five, six and seven, eight and nine and ten and eleven, a half road allowance of fifty links was also allowed for along the north side of the south boundary line and along the south side of the north boundary line. The concession lines in the centre of the road allowances, between concessions two and three and six and seven, were run from the exact points on the east boundary of the township due west astronomically to the west boundary, while the concession lines in the centre of the road allowances between concessions four and five, eight and nine and ten and eleven were run due east astronomically to the east boundary, and due west astronomically to the west boundary, from points established on the line in the centre of the road allowance between lots six and seven. Good posts made of the most durable wood to be had in the vicinity were firmly planted along the various concession lines, between the lots—one on the line itself as a guide post with the number of the lots cut on the east and west sides and the letter R cut on the north and south sides—one fifty links north of the guide post with the numbers of the lots cut on the east and west sides, and the number of the concession or R cut on the north or south sides as the case may be, at the intersection of the centre lines of the different side road allowances with the centre line of the different concession road allowances—good posts were also planted with the letter R cut on the north, south, east and west sides, good posts were also planted at the angle of each of the four adjoining lots with the number of the concession cut on the north or south side as the case might be, and the number of the lot cut on the east or west side as the case might be, and the letter R cut on the two sides facing the concession and side road allowances—these posts were planted at a distance of fifty links from the centre of the side road allowance and fifty links from the centre of the concession road allowance. Where the front angle of a lot fell in a lake or in the Mattawitchewan river the posts were projected to the proper points on the north or south or on the north and south sides thereon—these posts were

planted at a perpendicular distance of one chain from high water mark—witness posts with the numbers of the lots marked on the east and west sides were also placed at high water mark, and where they were to be had several trees in the vicinity were blazed in a conspicuous manner. A road allowance of one chain in perpendicular width is allowed for along each side of the Mattawitchewan river, also around all large lakes and around all lakes cut by the concession and side road allowances—all these road allowances are marked by good durable posts planted on the lines of survey with the letter R cut on the sides facing the road allowances. To all posts—with the exception of the guide posts—the witness posts—and the posts defining a road allowance—suitable bearing trees were marked—full descriptions of which will be found in the field notes. In order to make the survey more permanent in case of the destruction of the wooden posts by fire—iron posts made of iron tube one and one quarter inches in diameter—three feet long and painted red were placed at the points indicated I.P. on the township plan, these posts were marked with a cold chisel similarly to the wooden posts alongside of which they stand.

The township of Caithness is well watered by the Mattawitchewan river and several smaller streams which enters it on its course across the township. The river has an average width of about two chains and fifty links and varies in depth from a few inches to four or five feet—for the greater part of its way across the township it is made up of a succession of shallow rapids filled with boulders and remarkably sharp edged rocks, so much so that it can scarcely be said to be navigable in any sense of the word even for canoes. The water of the river is clear and of good quality and contains some averaged sized pike. One small water power with a head of four feet ten inches occurs on lot twenty-seven, concession eight, immediately north of the line in the centre of the road allowance between concessions eight and nine, particulars, etc., of which will be found in the traverse notes.

A stream called the Goat river which has a fair current and an average width of about eighty-five links enters the river from the south at lot thirty, concession five—the water in this stream which varies in depth from a few inches to three or four feet is pure and clear and contains some fair sized speckled trout.

There is only one lake of any importance in the township situated near its south east angle this is called Big Pike lake, this lake is almost land locked having no inlet or outlet of importance, the water which is pure and of good quality is of a greenish tinge and up to ten feet in depth—some good sized pike were procured in this lake.

The whole of the township of Caithness may be described as a more or less rolling country timbered with spruce up to fourteen inches in diameter, balm of gilead up to sixteen inches in diameter, poplar, white birch, balsam and cedar of an average size and quality. The undergrowth consists for the most part of alder and willow, while here and there considerable windfall is met with. Interspersed throughout are swamps covered with spruce and dead tamarac, and as a rule, grown up with a dense growth of alder. All these swamps have a considerable elevation above the waterways and will admit of very easy drainage. On the uplands, generally speaking, the soil is a black loam rich in humus and of from eight to twelve inches in depth entirely free from stone with a subsoil of clay. Quite a few outcroppings of rock (Huronian) but very limited in extent are met with, particularly around Big Pike lake and along the south boundary. I found no traces of mineral whatever. The average magnetic variation is about six degrees and fifteen minutes west of north. I would consider about fifty per cent. of this

township suitable for immediate settlement, and there can be no doubt that by a proper drainage of the swamps twenty-five per cent. of the remainder can be made suitable for agriculture. Game and fur of the usual kinds common to this section, and particularly moose, are to be seen in abundance.

Observations for azimuth on Polaris at elongation were taken at least once a week with the exception of the last two weeks of the work, which was almost a continuous downpour of rain. All the lines were run with the transit, well opened up and blazed, and carefully chained and posted by experienced hands. A careful traverse survey of the Mattawitchewan river and also of the lakes was made with the micrometer and transit, all the work closing in a very satisfactory manner.

I have the honour to be, Sir,

Your obedient servant,

(Signed) J. W. Fitzgerald,

Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ontario.

Appendix No. 22.

Survey of the Township of Ebbs, District of Algoma.

Toronto, December 22nd, 1913.

Sir,—We have the honour to submit the following report on the survey of the township of Ebbs, in the District of Algoma, made by us under instructions from your Department, dated the 12th day of July, 1913.

On 29th July we left Toronto, via the Canadian Pacific Railway for Franz, where the party was organized. The party was in charge of John van Nostrand, O.L.S., assisted by N. A. Burwash, O.L.S., and included five other men from Toronto and vicinity, and eleven men from Missinabie and Franz. We then proceeded to Oba by construction train on the Algoma Central Railway. From the railway the party and supplies were taken down the Albany Branch of the Oba river in canoes to the falls, a short distance above the line between lots 6 and 7, in the township of Scholfield. The supplies and camp outfit were then packed to that line and north along it to the line between concessions X and XI, then east to the east boundary and north on the east boundary, to the starting point of the survey, at the south-east corner of the township of Ebbs, in all, a distance of seven miles, more or less.

The township is bounded on the south by the township of Scholfield, and on the east by the township of Orkney, on the north by the townships of Lowther and Shetland, and on the west by the unsurveyed township of Templeton. The Algoma Central Railway passes about four chains west of, and fifteen chains north of the north-west corner of the township and runs in a north-easterly and south-westerly direction from this point, which is about twenty miles from the town of Hearst.

The part of the Albany Branch of the Oba river travelled over is at this time of the year a very shallow stream filled with large sharp boulders and shallow bars, and it was found necessary to load nineteen foot canoes to not more than half capacity in order to get them through at all. In fact, the part of the river between the line between lots 6 and 7, in the township of Scholfield, and the east boundary of that township, was reported to be in such bad condition that no attempt was made to travel over it.

The survey was commenced on 11th August and completed on 2nd October.

On arriving at the starting point it was found that the line forming the south boundary of the township or Orkney had not been run to its intersection with the east boundary of the township of Scholfield.

Proceeding as instructed we went east and picked up this line at the nine mile post and produced it west seventy-nine chains and eight links to the above-mentioned intersection.

From the point thus established the east boundary of the township of Ebbs was run north astronomically to the south boundary of the township of Shetland, thus establishing the north-east corner of the township of Ebbs, and the south boundary was run as an eleven mile chord of a parallel of latitude west to the west boundary.

All lines were run with the transit and frequent astronomical observations, the record of a number of which are appended, were taken to verify the courses of the lines run. All lines were well opened out and blazed.

Wooden posts of the most durable timber obtainable were planted at the points required by the instructions.

Iron posts, one and one-quarter inches in diameter, furnished by your Department, were planted alongside the wooden posts, at the following points:—

At the south-east corner of lot 13, concession I.
At the south-west corner of lot 24, concession I.
At the south-east corner of lot 1, concession V.
At the south-west corner of lot 12, concession V.
At the south-west corner of lot 24, concession V.
At the south-west corner of lot 34, concession V.
At the south-east corner of lot 1, concession IX.
At the south-west corner of lot 12, concession IX.
At the south-west corner of lot 24, concession IX.
At the south-west corner of lot 34, concession IX.
At the north-east corner of lot 1, concession XII.
At the north-west corner of lot 12, concession XII.
At the north-west corner of lot 24, concession XII.

A traverse was made of a small lake in lots 27 and 28, concession X, this being the only lake seen in the township.

Soil.

The soil in nearly the whole of the township is sandy, generally low-lying and wet, with a few dry patches. The wet land is covered with from twelve inches to thirty inches of moss and peat, and the dry land with from two inches to twelve inches of moss. The exceptions to this are the large muskeg areas which occur in the western part of the township, as shown on the plan and field notes, also occasional gravel beds. Not more than ten per cent. of the soil, in our opinion, is suited for ordinary agricultural purposes.

Timber.

The timber, except in the muskeg areas, is chiefly spruce, with tamarac (dead), poplar, birch, balsam and cedar. The spruce, tamarac and balsam average about five inches in diameter and are not of much commercial value. The poplar and birch occur on the drier ground in small areas and run from four inches to twelve inches in diameter. The cedar is small and scrubby.

The timber in the muskeg is stunted tamarac and spruce up to three inches in diameter.

The whole country shows evidence of having been fire-swept sixty or seventy years ago, and the timber has not since obtained its full growth.

Minerals.

No economic minerals were seen but in a great many places small stringers of milky quartz occurred in the greenstone outcroppings. A number of samples of the country rock accompany this report.

Game.

Moose and caribou were very abundant, several moose being seen during the progress of the survey. A few fresh beaver cuttings were seen in the north-west part of the township, but they do not appear to be very abundant. Marten were also seen. Spruce partridge were abundant, and pin-tailed prairie chickens were seen, exclusively in the muskeg areas. Rabbits were plentiful. No fish of any kind were obtained, the streams being too small.

Water Power.

No water powers occur in the township.

General.

In the south-east corner of the township all the streams are small, and are tributary to the Albany Branch of the Oba river. In the south-west corner of the township there is a large stream fifty links wide and three feet deep, with a fairly rapid current. This is a tributary of the Mattawisquia river. In the northern half of the township all the streams are small except for two fairly large creeks which rise in the township and unite after leaving it to form the Beaver river. These streams afford good natural drainage for the land within their influence, except the muskeg areas which would require considerable work to drain.

The general topography is almost level, with very gentle undulations and low outcroppings of greenstone rocks which do not rise much above the general level.

The returns accompanying this report comprise a general plan, a timber plan, field notes of the entire survey, also account in triplicate.

We have the honour to be, Sir,

Your obedient servants,

(Signed) Speight & Van Nostrand,
Ontario Land Surveyors.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 23.

SURVEY OF THE TOWNSHIP OF LOWTHER IN THE DISTRICT OF ALGOMA.

PARRY SOUND, December 16th, 1913.

Sir,—I have the honour to submit the following report on the survey of the township of Lowther in the District of Algoma, performed under instructions dated the 7th of July, 1913.

I proceeded to my work by way of Cochrane and thence by Grand Trunk Pacific Railway to Hearst and from there I moved into the township of Lowther along the grade of the Algoma Central and Hudson Bay Railway, and commenced my survey at the north-east angle of the township at the post planted by Ontario Land Surveyors Sutcliffe and Neelands and chained westerly along the north boundary making each lot 25 chains and 25 links wide, excepting lot 6 which I made 24 chains and 94 links wide, allowing for convergence of meridians across the township; here I observed Polaris for meridian and ran the centre line of road allowance between lots 6 and 7 due south, making said line my base for starting the several concession lines throughout the township running east and west.

This township was surveyed under the new method of survey approved of by Order in Council dated April 24th, 1906. Under this system I surveyed 12 concessions numbering from south to north with a road allowance of 50 links wide on each side of the outlines of the township and one chain wide between every second concession, namely between concessions 2 and 3, 4 and 5, 6 and 7, 8 and 9, etc., and a blind line between the other concessions namely, 1 and 2, 3 and 4, 5 and 6, 7 and 8, etc., with a road allowance 1 chain in width between every six lots, the lots being numbered from east to west.

This township was laid out with a double front on each concession road allowance run on the ground. I ran the concession lines in the middle of the road allowance between each alternate concession as chords of a parallel of latitude passing through the township corners and the side lines between every sixth and seventh lot in the middle of the road allowance on a course north astronomically.

I planted firmly in the ground at the front angles of the lots at right angles from my centre line of the concession road allowance, durable and substantial posts of the dimensions given in the general instructions, at the distance of 50 links on each side north and south of my line. I also planted posts in the centre of my lines of survey as guide posts. These posts were marked as per instructions. At the intersection of the centre of the different side road allowances with the centre line of the different concession road allowances I planted a post marked "R" on each of the four sides.

The Algoma Central and Hudson Bay Railway extends in a general north-easterly direction across the north-west angle of the township. I allowed a road allowance one chain in width, along each side of the right of way. The line of the said railway has been accurately plotted on the plan accompanying this report. Road allowances, one chain in width, were also left about the several lakes met with in the survey of the township, these being posted as per instructions. In chaining the boundaries of the township I noted the chainage to all survey posts planted on these lines in former surveys and have shown in the field notes of my concession and side lines the amount of jog which my lines made with those in the adjoining townships.

In surveying the side road allowances I did not plant posts at the blind concession lines, but gave the adjoining concessions an equal depth, assigning to each half the distance between alternate concession road allowances.

My lines of survey were well cut out and well blazed and all of the lines were run with the transit. Astronomical observations for the meridian were taken at least once a week to verify the direction of my lines. The field notes were kept as per instructions.

With a view to making the survey permanent in case of fire I planted alongside the wooden posts an iron post at the points indicated on the projected plan accompanying my instructions. These posts were marked with a cold chisel similarly to the wooden posts alongside which they were placed.

All waters within the limits of my survey were surveyed and connected with my lines of survey whether or not such waters were intersected by the concession or side lines run by me. The survey of these lakes has been plotted on a scale of ten chains to the inch and accompanies this report.

Timber.

The timber throughout the township is spruce from 4 to 10 inches in diameter, excepting some small areas of poplar and white birch, as shown in the field notes.

Soil.

The soil is clay with some small areas of lighter soil in the vicinity of outcroppings of granite rock which occurs in a few places as indicated in the field notes. There is considerable swampy ground but very little muskeg, and the swamps will all be easily drained as the creeks and water courses are considerably below the general surface of the ground.

Minerals.

I saw no indication of mineral in the township.

Lakes.

There are only a few small lakes in the township and I doubt if there are any fish; at least we were not able to catch any with hook and line.

Game.

The only game I saw in the township was moose.

I have the honour to be, Sir,

Your obedient servant,

(Signed) David Beatty,
Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto. Ont.

Appendix No. 24.

Survey of the Township of Orkney, District of Algoma.

Sault Ste Marie, Ont., January 20th, 1914.

Sir,—We have the honour to submit the following report on the survey of the subdivision of the township of Orkney, in the District of Algoma, made by us under instructions from your Department of July 2nd, 1913.

We arrived at Franz on the Canadian Pacific Railway on the morning of July 13th, and proceeded northward on a construction train to Oba on the Algoma Central Railway. From this point we canoed down the Little Albany river to the south-east angle of the township of Orkney and commenced work on July 18th.

We ran our concession lines and side lines in accordance with instructions in the regular way. An error in chainage was made on O. L. S. Speight's meridian, and the lines between the second and third concession and the fourth and fifth concession were cut for a distance of four (4) miles each, from points fifty (50) links too far south. We ran these lines over again in their correct positions, which we now feel was a mistake. However, as these lines exist in the field we show them on our notes.

Physical Features.

The entire area which we covered was gently undulating country, heavily wooded with poplar, balm of gilead, spruce and white birch. There are no outcrops of rock of any moment to our knowledge in the township. We only encountered three small lakes in cutting our lines and did not discover any within the limits of the lots, aside from these.

Soil.

Practically the entire area within the township of Orkney is good agricultural land. In the lower areas, strong clay loam is covered by humus to a depth varying from three to twelve inches. Fully half the township, however, is clay loam without any appreciable covering of decayed vegetation and could be farmed at the present moment without drainage.

Timber.

The prevailing tree is certainly the poplar, which grows to a great height on all ridges and dry land. In the muskegs there is a considerable quantity of spruce which is for the most part small in size. Besides these two trees there is a considerable growth of birch, balsam, balm of gilead. There is no brule and our timber plan is uncoloured.

Waters.

The Missanabie river runs through the length of the township and is joined by a tributary of considerable size, the Mattawitchewan in concession 5. The flow of the Missanabie river at low water period, we would judge to be about five hundred cubic feet per second. There are, however, no falls within the township and no rapids of sufficient drop to warrant water power development. There are only three small lakes, all of which are shallow with marshy shores.

Fish and Game.

In the Missanabie river we caught, by means of a net, pickerel, pike and suckers. We learned from the Indians that there were also speckled trout to be got in certain places. There are numerous moose and black bear in the woods, also rabbit and partridge in great numbers.

Accompanying this report we submit plans, field notes and account in triplicate.

We have the honour to be, Sir,

Your obedient servants,

(Signed) Lang & Ross,

Ontario Land Surveyors.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 25.

Survey of the Township of Scholfield in the District of Algoma.

Pembroke, Ont., October 30th, 1913.

Sir,—I have the honour to submit the following report on the survey of the township of Scholfield, in the District of Algoma, in accordance with instructions dated July 3rd, 1913.

I commenced my survey by chaining and parting the south boundary which was run by O.L.S. Speight in 1910, from parts thus established the side lines were run north astronomically, the concession lines were run west astronomically giving the depth shown on the field notes.

The east boundary was run north from Speight's 10 mile post a distance of 9 miles where I planted a post. The north boundary was run this summer by Speight and Van Nostrand after I had completed my survey, and they posted the north boundary of my township for me, and supplied me with the field notes of same, which I have included in my returns.

Wooden posts were planted at the corners of all lots and guide posts on the centre lines of the concessions. Bearing trees were marked for all lot parts, and recorded in field notes. Iron posts were planted alongside wooden lot posts where directed to do so by the instructions. All lines were well cut out and blazed.

I made a careful traverse of the Mattawitchewan river and of all the islands therein, marking a post for each, the notes of which are recorded in the traverse table. I only found one small lake in the township, which I also traversed.

A road allowance was left on each bank of the Mattawitchewan river and around the lake above mentioned.

Frequent observations for azimuth were taken.

TIMBER.

The township is thickly covered with timber, principally small spruce from 4 in. to 8 in. in diameter, with areas of poplar, balsam, tamarac, cedar and birch, scattered throughout, varying in size from 6 in. to 12 in. in diameter.

SOIL.

The soil generally is clay covered with moss from a couple of inches to twelve inches in depth. The north-westerly portion of the township is low and swampy, the north-easterly portion having the best land and being fairly level with a good clay soil. Along the Mattawitchewan river the land is rolling with frequent outcrops of rock.

MINERALS.

No economic minerals of any kind were found.

LAKES AND STREAMS.

Only one small lake was encountered, this being shallow with a muddy bottom, and no appearance of fish of any kind in it. The Mattawitchewan river is a turbulent stream with many rapids and numerous islands, only three of the latter being over one acre in area. Islands "S" and "T" in concession 1, lying between lots 29 and 31 being the most important. This stream is very shallow in depth during summer months making it difficult to navigate with canoes excepting in high water. During the spring freshet the water rises ten or twelve feet above the low water level, and owing to the small volume of water after the freshet has passed I do not consider that there are any sites suitable for power development.

FISH AND GAME.

In the early summer there is good trout fishing at the falls and rapids in the Mattawitchewan river. Speckled trout weighing about two pounds being occasionally taken. Pike of fair size were taken during the summer.

Moose were fairly plentiful.

Taken as a whole, I consider that about 75 per cent. of this township will be available for agricultural development, the timber being chiefly valuable for pulpwood.

Accompanying this report are, a timber plan, general township plan and the customary field notes, etc.

I have the honour to be, Sir,

Your obedient servant,

(Signed) HERBERT BEATTY,

Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 26.

SURVEY OF THE TOWNSHIP OF TALBOTT IN THE DISTRICT OF ALGOMA.

SUDBURY, ONTARIO, December 5th, 1913.

SIR,—I have the honour to submit the following report on the survey of the township of Talbott, in the District of Algoma, under instructions from the Department of Lands, Forests and Mines, dated July 3rd, 1913.

The township is situated on the line of the Algoma Central and Hudson Bay Railway, about eight (8) miles north of Oba, the junction of the Algoma Central and Hudson Bay Railway with the Canadian Northern Ontario Railway.

The south boundary of the township was run by O.L.S. Speight in 1910. The east, north and west boundaries were run by O.L.S. Sutcliffe and Neelands in 1912.

A road allowance of fifty (50) links was left along the boundaries, and a road allowance one chain in width between lot six (6) and seven (7), twelve (12) and thirteen (13), eighteen (18) and nineteen (19), and twenty-four (24) and twenty-five (25); also between concessions two (2) and three (3), four (4) and five (5), six (6) and seven (7). eight (8) and nine (9), and ten (10) and eleven (11). The lines were run in the centre of the road allowance.

The side road lines were run due north and south and the concession lines as chords of a parallel of latitude.

Posts were planted on the concession line, on the centre line of the road allowance and at off-sets of fifty (50) links north and south therefrom.

Eleven (11) iron posts were planted as required in the instructions at the following points:—

On the south boundary, at the south-west corner of lot twelve (12), and at the south-west corners of lots six (6). eighteen (18) and twenty-eight (28) in the fifth concession, and at the south-east corner of lot one (1) in the same concession, also at the same relative corner in the ninth concession. On the north boundary at the north-west corner of lots six (6) and eighteen (18).

The compass variation was found to be 6 degrees west.

The timber for the most part is spruce, varying from 4 in. to 10 in. in diameter. Along the south boundary and on the ridges there is considerable birch. poplar and balsam. There is no pine of any kind in the township.

The low ground is covered with a thick moss and black muck, the subsoil being clay. From the appearance of the borrow pits along the railway, boulders lie everywhere under the moss. The ridges are of sandy loam with some gravel. but generally good farm lands.

There are several lakes in the township: Irene and Wigwam lakes are deep with stony shores; Katsas lake is rather shallow and has sandy shore. The remaining lakes are shallow and dirty. Some of the smaller ones are simply mud holes. The creeks are shallow and muddy. All the water is quite dark.

Pike and pickerel are the only fish found in the lakes. Some of the smaller streams abound with trout.

There is very little rock in evidence in the township and no mineral at all was found. There are a few outcroppings of diorite in the south-eastern part of the township, and towards the north-west along the railway, some granite is

in view. The contact between the diorite and granite is in concession 8. Samples of rock taken at various places are forwarded with this report.

Accompanying this report are the plans and field notes, also my account in triplicate.

I have the honour to be, Sir,

Your obedient servant,

(Signed) J. Richard Gill,
Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 27.

Survey of the Township of Shetland, District of Algoma.

Little Current, Ont., December 1st, 1913.

Sir,—I have the honour to submit to you the following report on the survey of the township of Shetland, in the District of Algoma, performed under instructions from your Department, dated Toronto, July 9th, 1913.

I proceeded to the work by Cochrane and the National Transcontinental Railway to the crossing of the Missanabie river, thence by canoes up that river and a large creek in the first concession. This creek empties into the Missanabie in the twelfth concession of Orkney.

I depended on getting Indians at Cochrane for the work as I had arranged, but found on my arrival there that hardly any were to be found. I also learned there that some of those employed on surveys and similar work were receiving 90 dollars per month and expenses. I therefore engaged men from the Lake Huron country which made my expenses for transportation unusually heavy. The fare by the contractor's train from Cochrane to the Missanabie River, 110 miles, is $5.50 each way.

All lines were run with either a transit or solar compass. Nearly all the meridian work was done with a transit, and all the concession lines, except the south boundary and the last five lots in each concession, were run with the solar.

The lines were well opened up and blazed. Iron posts, 1¼ inches in diameter, supplied to me by your Department, were planted as requested at the south-west angle of lots 6 and 18 in concessions 1, 5 and 9, also at the south-east angle of lot 1 in each of concessions 5 and 9, and at the north-west angle of lots 6 and 18 in concession 12. There were not enough posts supplied to me to plant them at the other two corners indicated on the projected plan sent with the instructions.

Durable wooden posts, mostly spruce and cedar, and of required dimensions, 5 inches square at the ends of concessions and the intermediate ones, 4 inches square, were planted at the front angles of the lots. On them were marked "R" for road, and the numbers of the adjacent lots and concessions. The iron posts were similarly marked.

On the side roads no posts were planted at the rear of the concessions.

The country generally is level or gently undulating with an occasional gradual rise to about 100 feet.

The soil is nearly all a clay bottom overlaid with black muck of varying depths. In the west and north-west there are a few small exposures of granite. A few gravelly knolls and an occasional boulder were also seen in those directions. From careful observation it was estimated that at least 75 per cent. of the land in the township is well adapted to farming. This includes the swamp areas for which there is good drainage into the creeks. In the vicinity of the large creeks in the south half of the township the land is particularly desirable.

The timber is black and white spruce, poplar, balsam, white birch, cedar, balm of gilead, tamarac and a very few jack pines, and range in size from 3 to 15 inches in diameter. Most of the timber is large and merchantable, except the green tamarac which does not exceed 4 inches in diameter. In a number of the swamps good cedar to about 12 inches in diameter was found. In many places groves of very large poplar were seen.

No old brule country with small timber was met with, except in a few places near the west boundary.

The large creek in concession 1 is navigable in places for canoes. It is greatly broken with shallows and boulders. In the high water in the spring a great deal more of it is no doubt navigable. There are no falls on it of any importance.

There are moose but apparently very few caribou or deer. Pike and pickerel were caught in the large creek.

Great care was taken to thoroughly extinguish all our fires before leaving a camp.

I have the honour to be, Sir,

Your obedient servant,

(Signed) T. J. Patten,
Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 28.

Survey of the Township of Drayton in the District of Kenora.

Ottawa, January 2nd, 1914.

Sir,—I beg to submit the following report on the survey of the township of Drayton, in the District of Kenora under instructions dated July 14th, 1912.

After the completion of the work in the Mattawa District myself and assistant proceeded to Fort William via Canadian Pacific Railway, and to Sioux Lookout via Grand Trunk Pacific Railway.

On arriving at Sioux Lookout a party was made up not without considerable difficulty owing to men demanding such high wages. Eventually men were secured at reasonable rates.

The party then proceeded to Superior Junction by railway and packed the camp outfit down the Grand Trunk Pacific Railway to where it crosses the southerly boundary of Grand Trunk Pacific Block 10.

The work was carried on in a westerly and southerly direction, all traversing being carried on in conjunction with the blocking out so that both classes of work could be done to advantage.

Owing to stormy weather it was impossible to obtain as many observations as we would have desired without unnecessarily delaying the work.

Both north and south of the National Transcontinental Railway from lot 24 to lot 32 (both inclusive) the country has been burnt and the mining claim lines and posts obliterated, while farther away from the railway it was found very difficult to pick up any trace of some of these, especially to find any posts; however, posts were located on the following claims, viz., A.L. 527, A.L. 528, H.W. 780, S.V. 460, S.V. 461, S.V. 463, H.W. 762, H.W. 717, H.W. 719, H.W. 720 and B.J. 18, these having been plotted from data obtained in the field and the others being plotted from information supplied to us with our instructions, are found to check very closely. No traces of H.W. 715 or H.W. 716 were obtainable as all the area included in these mining claims was cleared, the timber being used for cordwood by the Northern Pyrites Mining Company, the brush being piled up waiting for a favorable opportunity to burn it.

Rock Formation.

Generally speaking the township is rough and broken, being composed of diabase rock of the Huronian period. A great many mining claims have been taken up and considerable work has been done on them, the chief one being the Northern Pyrites Mining Company on Big Vermillion lake who employ from eighty to one hundred men continuously in taking out iron ore for commercial purposes. A few mining claims were staked out for gold, but up to the present time there are no producing gold properties in the township. In the reserve south of Grand Trunk Pacific Block 10, between Dobie's seven and eight mile post, a bed of clay suitable for making fire brick and pottery has been discovered, and we understand that a company has been formed to develop this clay proposition.

Timber.

In that partion of the township east of Minnietakie and Abram's lakes there is no timber of any commercial value and the part from lot 1 to lot 10 consists of brule, stunted spruce and underbrush. That portion of the township from lot 21 to lot 34, generally speaking, is covered with jack pine, spruce, balsam, birch and poplar of small pecuniary value. There are, however, two portions (shown red on timber plan accompanying this report) where marketable timber exists, the first is in concessions one, two and three, lots 21 to 27 inclusive, and consists of jack pine of large size, suitable for ties and piling. The second is in concession four, from lot 28 to lot 34 inclusive, and consists of red pine from 6 to 18 inches in diameter.

Game.

The whole district abounds in game, principally moose, deer, caribou, mink, muskrat, ermine, otter and fox, while in the lakes a great variety of excellent fish is found.

Water Powers.

Abram's chutes in lot 16, concession four, at this point there is a drop of two feet with a large volume of water passing through a narrow gorge having on both sides high banks which lend themselves adaptable to the erection of a dam. Minnietakie lake is approximately one hundred miles in area, thus forming an admirable reservoir for the possible conservation of water. We did not make an examination of the westerly or southerly shores of this lake, consequently have no information as to the area of land that would be flooded by the erection of a dam. We estimate this power at eight hundred (800) horse power.

Pelican chute in lot 27, concession C, there is a fall of twelve (12) feet from the upper level to the lower level here, the shores of the Sturgeon river and island F.P. 99 are well adapted to the construction of dams. We estimate this power at thirty-five hundred (3,500) horse power.

Vermilion river falls in lot 31, concession A, the head here is seventeen (17) feet six (6) inches and has some large lakes behind it which ensures a constant flow of water over the falls. In February and March we estimated this power at six hundred (600) horse power, being at low water.

Soil.

From lot 1 to 16 the land is generally rough and rocky with small patches of clay loam suitable for light farming. From lot 21 to 34, concessions 2, 3, and 4, the soil is composed of a sandy loam not very suitable for farming purposes, although in low places there are small patches of clay loam of a very fair quality. From lot 21 to lot 32, concessions I, A, B and C, the land is of a somewhat heavier clay loam and fairly suitable for agricultural purposes.

We beg to draw to your attention the fact that owing to the township being broken into two parts by Abram's lake, possible settlers would have to depend on transportation by boat to get in and out of the market town (Sioux Lookout). In our opinion the most feasible route for opening up the westerly portion of the township would be the construction of a road from Sioux Lookout southerly through the reserve to Pork rapids (lot 20, con. 2) thence westerly through con. 2 or con. 3.

The total cost of the survey of this township is $9,422.75, of which $2,550.00 is chargeable to 165 miles of traversing, being an average of $15.00 per mile. The remaining cost $6,872.75 being chargeable to land subdivision of which there was approximately 60,000 acres blocked out which is an average of 11½ cents per acre.

Accompanying this report are, a plan of the township on mounted paper, a timber plan on tracing linen, field notes, paylists and accounts.

We have the honour to be, Sir,

Your obedient servants,

(Signed) Patterson and Byrne,

Ontario Land Surveyors.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 29.

Survey of the Township of Malachi, District of Kenora.

New Liskeard, Ontario. April 25th, 1914.

Sir,—In compliance with instructions from you bearing date of August 13th, 1913, we proceeded with subdivision of Malachi township after completing outlines of Pelican, Malachi and Rice, and herewith beg to tender our report and accompanying plans and field notes of the same.

Through some misunderstanding your instructions were not forwarded from Kenora to Malachi as per our request to the party in Kenora with whom we made arrangements; consequently we were about ready to leave when we received same.

We immediately wired our Liskeard office to send first class chainmen, but it was difficult at that time to get all round men on short notice so we only secured one. Our assistant Mr. Gallagher and our Mr. Neelands each had charge of a gang of axmen working from the same camp, and starting from the south and east checked up in the usual manner by blocking off instead of running more than one day without a check.

We had as rear chainmen a three year S.P.S. man and an Upper Canada graduate now at S.P.S., while as head chainmen we used two of the most intelligent halfbreeds in our employ. As the country was quite rough in places we found considerable difficulty in getting chainage to check very closely, but we kept an accurate angular check on all intersections. The only line that we consider seriously out is the one between the 3rd and 4th concessions which was swung at the intersection of the 3rd side line and 3rd concession line on account of the chainage being 57 links long, and besides, having come over some rough country. However, we found later on that it would have been better to have depended on angles in preference to chainage, as the country was too rough for very accurate work. Our chainmen took time and care as the two gangs could not keep up to the axmen: the falling behind was in a measure due to our having several of the lines checked up. The principal errors found were in using shore chainage instead of triangulation points. The odd chainage in the case of the width of two lots which otherwise would have been the even forty chains was due to these mistakes being discovered when copying the notes.

On account of the north boundary of the township showing longer than the south in the outline work, we decided that the work would come out better to not give the full convergence to the side lines. This accounts for the distances on the north boundary between the side lines and the mile posts, being so nearly the same.

We found after having chained several of the concession lines across lots 1 and 2 that the first mile of the south boundary on the triangulation across Pelican Pouch lake must be in error. This was checked when traversing Pelican Pouch lake and found correct; the error being in the chainage across the front of Lot 2 in the 1st concession, and this accounts for the width of this lot.

We endeavored to keep all lines as straight as possible and if any slight change in bearing had to be made, to make same at an intersection.

All posts are either spruce, jack pine or tamarac or cedar, mounded with stones whenever stone was available—and this was mostly the case. Two bearing

trees were also used for each post and taken in such a manner as to accurately locate the post if lost.

Iron posts supplied by your Department, were planted at points indicated on plan and marked as shown on field notes.

Observations were taken at points shown on plan and as the time of the year made observations on polaris at elongation convenient, all observations shown were taken at this time.

Agriculture.

The best land in this township lies south of Malachi, Duck and Marshy lakes Of this, about two-thirds is sand or rock; the remaining third is thin spruce swamp with good land between it and the higher ground. Between Malachi and Burwash lakes there is a small area of good land which extends around Burwash lake to Jack lake. There are also small areas to the north-west and north-east of Muddy lake, south of Charles lake, east and west of Marshy lake, and east and north-east of Simpson lake. Between Malachi and Duck lakes there are also patches of good land. The sandy land in this locality is for the most part well timbered and with the ideal climate which it enjoys, should be fairly productive if properly worked.

That portion of the township surrounded by Duck, White, Pelican, and Marshy lakes is practically all bare rock or sand, on which blueberries grow in large quantities, but which is worthless from an agricultural standpoint.

West of Malachi lake, particularly in concessions 4, 5 and 6, there are small patches of fairly good land, and east of Pelican Pouch lake in the same concessions; but practically all the remainder of the township north of Duck lake, with the exception of island "F" and a point of land south-east of island "F" and around the south-west shores of Otter lake and the west shore of White lake, is very poor from an agricultural standpoint.

We estimate that there is possibly one-third of the land area of the township that is fit for agricultural purposes. Of this, one-half is a light sandy soil.

Timber.

Spruce, tamarac, poplar, birch, balsam, and jack pine covers most of the good land, while that portion that is of little agricultural value is covered with second growth poplar, birch or jack pine.

A section of country between Muddy and Precipice lake is timbered with jack pine, much of which is large enough for ties, and in a few years will be a valuable asset.

Minerals.

No trace of any economic minerals was found—the entire country rock being of Laurentian granite; that part to the south being of a reddish color and containing glassy blue quartz veins, while farther north along the railroad it was of a greyish color, breaking readily along almost horizontal lines and presenting a rather striking banded appearance.

Fruit.

Blueberries, wild plums and raspberries seem to thrive, although the latter two were not very widely distributed. The climate, however, seems adapted for growing berries of all kinds.

Game.

We used the net furnished by your Department, with varied success, and found large pike and pickerel in Malachi lake; small pike in the other lakes; and suckers in Pelican Pouch. The natives informed us that white fish are plentiful in Malachi lake, but we saw no trace of them.

Red deer, caribou and moose seemed plentiful, and their trails lead from lake to lake over the entire township.

Ducks are very plentiful on Muddy and Marshy lakes, while prairie chickens were seen in considerable numbers on the bare rock and sand north-east of Duck lake. In the lighter timber through the northern portion of the township, partridge also are plentiful.

Coyotes were heard frequently, while mink, martin, porcupine and muskrats were seen occasionally. Rabbits did not seem as plentiful as in other parts of Northern Ontario, but on the whole we consider the township abounds in game.

Summer Resort Locations.

On Malachi lake there are many places along the shore suitable for summer resorts; the sand beaches being very desirable, but much of the shore which is paved with small boulders slopes gently under the water.

The islands are mostly rocky; island "F" being the only fertile one. The large island "A" in the southern portion of Malachi lake is well timbered, but very rough. All the islands, however, could be used for resorts.

Physical Features.

The country for the most part is rolling; all marshy lakes have a considerable area of flat or gently rising land around them—Marshy and Muddy lakes being typical of this class.

White lake, Charles, Jack and Dutch lakes have for the most part gently sloping shores with clear water, of considerable depth.

Otter, Black, Precipice, and the southern portion of Malachi lakes have deep. dark waters, but very clear when removed from its dark shores.

The waters of Pelican Pouch lake during August and September were covered with a thick green scum, giving it the appearance of a saturated solution of paris green. Under this scum the water was transparent and good for drinking purposes.

The creek which drains Malachi lake is navigable for canoes to Otter lake,

The narrows draining Pelican Pouch lake into Otter are interrupted by a waterfall of 10 feet and 3 inches in height, very easily developed, but capable of developing only 100 h.p. If all the natural discharge was held on Pelican Pouch lake and if water was raised another five feet by dam the horsepower could be increased by 50. These falls being situated just where the waters of Pelican Pouch lake discharge into Otter lake, is quite convenient to the railroad which

passes along the north shore of it. The construction of a saw-mill at this point could be economically accomplished, and with dead water over Pelican, Catherine and Marshy lakes, timber for lumber, ties, etc., could be quite easily driven or towed to the mill site.

The general character of the country is such that we would advise a careful inspection of same before too much is subdivided, as much time, money, and annoyance could be saved by subdividing only those portions fit for agriculture.

Trusting that the above report may supply the desired information and hoping that same meets with your approval.

We have the honour to be, Sir,

Your obedient servants,

(Signed) SUTCLIFFE AND NEELANDS,

Ontario Land Surveyors.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 30.

SURVEY OF THE TOWNSHIP OF MATTAWAN IN THE DISTRICT OF NIPISSING.

OTTAWA, September 16th, 1912.

SIR,—I beg to submit the following report on the survey of part of the township of Mattawan, in the District of Nipissing, under instructions dated July 12th, 1912.

The party was outfitted at Ottawa and on the first day of August, 1912, left for Mattawa.

After questioning all the settlers in the district to be surveyed, it was found that the nearest post to the work that was known to any of them was that between lots 33 and 34, on the north side of the road allowance between concessions 7 and 8.

There the survey was commenced and by running a line on the approximate bearing, always looking for evidence of the true line and when such evidence was found these points were joined up by straight lines. In this manner the following intersections were obtained, viz.:

lots 10 and 11, concessions 7 and 8.
lots 15 and 16, concessions 7 and 8.
lots 20 and 21, concessions 7 and 8.
lots 10 and 11, concessions 9 and 10.
lots 15 and 16, concessions 9 and 10, and
lots 20 and 21, concessions 9 and 10.

Posts were planted at these intersections, the chainage between them carefully ascertained, and other posts were planted to mark the lot corners by proportioning the chainage according to that given in the original field notes.

Owing to the fact that lumbermen have been operating in this country for a great many years and also owing to the fires which have over-run this territory, evidence of the original lines has, in places, been completely obliterated.

A traverse was made along the concession lines across lots 11 to 20 and also on the road allowances between lots 15 and 16, and between lots 20 and 21. No traverse was made of the road allowance between 10 and 11, as the true line was not cut out all the way.

I enclose plans in duplicate, field notes and also accounts in triplicate.

I have the honour to be, Sir,

Your obedient servant,

(Signed) Frank E. Patterson,

Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 31.

Survey of the Township of Stirling in the District of Thunder Bay.

Renfrew, Ont., October 30th, 1913.

Sir,—I have the honour to submit the following report on the survey of the township of Stirling in the District of Thunder Bay, performed under instructions dated the 14th day of July, 1913.

In pursuance of instructions, I commenced my survey at a point on the west boundary of the township of Lyon, four miles south from the north-west angle of that township, this point being eighty-five links north of the post planted by Ontario Land Surveyor Bolton, to mark the line between lots 8 and 9 in the eleventh concession of that township.

From this point I ran the side line between lots 4 and 5 west astronomically and along it laid off concessions giving each concession a depth of eighty chains. I then laid out the township in the usual way, giving each lot a width of forty chains and each concession a depth of eighty chains. No road allowances were left in the survey of this township.

On the concession lines I planted substantial posts (wooden) to mark the angles of all the lots. All posts were planted accurately on the survey lines and two bearing trees were taken for each post planted, and where stones were obtainable, I placed a mound of stones around the posts.

As this township was laid out in single front concessions, therefore, the posts planted between lots where no side lines were run, that is between lots 1 and 2, 3 and 4, 5 and 6, etc., on the front of the second concession for example, having no connection with the side lines in the first concession, were, therefore, marked with the concession number on the west side only and the lot numbers on the north

and south sides and the same in all the other concessions. The posts planted between lots 2 and 3, 4 and 5, etc., where the side lines were run, refer to both concessions and were, therefore, marked with the concession number on both the east and west sides, and with the lot numbers on the other sides. On the west boundary I planted posts only at the intersections of the side lines with that boundary. I brushed out and chained the east boundary of the township, and in my chainage have shown the positions of all posts planted on this line in the former survey.

Where the front angle or angles of a lot fell in a lake or river, I projected and planted the post in the proper place and have shown in my field notes the position of such posts. Where the intersection of a concession and side line came in a lake or river, I planted a post above high water mark at each of the four points in which these lines intersected the shore of such lake or river.

In performing the survey the lines were well cut out and blazed. Astronomical observations were taken at least once a week on Polaris at elongation to verify the direction of my lines.

The field notes were kept according to instructions, giving first the east boundary, then the line between the first and second concession, next the line between the second and third concession and so on, then the side line between lots numbered 2 and 3, throughout the various concessions, then the side line between lots 4 and 5 throughout the various concessions and so on.

According to instructions I tied in my survey with the Canadian Northern and the Canadian Pacific Railways, and have plotted them correctly on my plan and have computed the areas of the several lots or parts of the lots through which they pass.

With a view of making the survey permanent in case of fire, I planted, alongside the wooden posts, iron posts, at the points indicated in red on the projected plan accompanying my instructions. These posts were marked with a cold chisel with the numbers of the lots and concessions, similarly to the wooden posts alongside which they are placed. The positions of these posts are shown in my field notes.

All waters within the limits of the township were surveyed and connected with my lines of survey, whether such waters were intersected by the concession or side lines run by me, or not. These surveys have been plotted on a scale of ten chains to the inch. The survey of Wolf river and the lakes in the township were carried out by means of the stadia, except in the case of lakes intersected by the survey lines, where the distances were obtained by triangulation in the usual way.

Accompanying this report is a plan on a scale of forty chains to the inch, showing the natural features of the country, also field notes of the township and a timber plan of the same.

Under date of August 23rd, 1913, I wrote Mr. Kirkpatrick to the effect that I was unable to locate the north boundary of the township of Dorion, this line forming the south boundary of the township of Stirling. The old blazes and marks had been obliterated by fire. I re-ran the whole of this line. Mr. Kirkpatrick replied under date October 17th, 1913, that I will, therefore, be allowed to charge the amount per mile as in the other parts of the township according to instructions. On my plan I have shown locations A.L.663, A.L.561, A.L.633 and E.D.405A according to instructions. I beg to report on the natural features of the country under the following heads:

Timber.

The greater part of the township is thickly timbered with spruce, balsam, poplar, birch, and cedar, varying in size from two to eight inches in diameter. In the north-easterly part of the township a considerable quantity of large cedar was encountered, running from ten to thirty inches in diameter. In the northerly half of the township, through concessions four and five there is a great quantity of spruce, four to ten inches in diameter.

Soil.

Good agricultural land was met with in the south-easterly part of the township, this being in the locations mentioned above. This same soil prevails through concessions 1 to 5, from lots 1 to 6. The south-westerly part of the township traversed by Wolf river, is of no value as agricultural land except in a few isolated spots. It is for the most part very rocky with steep rocky hills. In the north-easterly part of the township there is some land of agricultural value, some clay soil being met with in this section. The central part of the township is of no value for agricultural purposes, it is very rocky. About the lake, shown in concessions 4 and 5, lots 8 and 9, there are precipices with from 150 to 200 ft. sheer drop. As shown in the notes, there are other such places to be met with in the westerly part of the township. The north-central part of the township is exceptionally good for agricultural purposes, the soil being for the most part of the same sandy formation as met with in the south-easterly part. The settlers in this south-easterly part of the township have met with considerable success in the cultivation of this land and it is to be pre-supposed that the soil in the parts mentioned above will yield to the same treatment. In general I would report that in my estimation about fifty per cent. of this township is available for agricultural purposes, including the locations above mentioned.

Minerals.

No traces of minerals of economic value were met with in the survey of this township. The south-westerly part of the township has been thoroughly prospected and some claims staked out, but nothing to warrant favorable mention was met with by me, either in the part mentioned or in the other parts of the township.

Lakes.

As shown on the plan and field notes, eleven lakes were met with in the course of the survey of this township. These were all traversed. They are, for the most part, deep and clear, well stocked with fish.

Wolf River.

This river traverses the south-westerly part of the township, flowing in a general south-easterly direction and emptying into Lake Superior. It varies in width from half a chain to two and a half chains. It is, for the most part, very shallow. The current is quite swift, readings taken showing an average rate of flow of about three miles per hour. This river was traversed from where it enters the township on the west boundary to where it leaves on the south boundary. Four rapids were met with these giving a total fall of twenty-seven feet. Four

falls were also encountered, these giving drops of 3 ft., 18 ft., 21 ft., and 30 ft. respectively. This stream is available for power development, the most promising place being at the thirty ft. fall mentioned above, this being in lot 1, concession 5. There is a wagon road leading from this falls to the town of Dorion on the Canadian Pacific Railway. I have shown on my plan and traverse plan reservations for power development in concession 5, lots 1 and 3, and in concession 6, lot 3, these adjoining the most favorable power sites on the river.

Game.

Signs of deer were quite plentiful throughout the township, as were also signs of moose, notably in the northerly part of the township. Rabbit and partridge seemed very scarce. There were many signs of beaver met with in the northerly part. The lakes, as mentioned above, were well stocked with fish, trout being very plentiful as well as pike. Wolf river, in particular proved to be a good trout stream.

Accompanying this report are field notes, index plan, general plan, chainbearers' oaths and accounts in triplicate.

I have the honour to be, Sir,

Your obedient servant,

(Signed) J. R. Allan,
Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 32.

Survey of Part of the Township of Gorham, District of Thunder Bay.

Port Arthur, March 17th, 1914.

Sir,—I have the honour to submit herewith the following report on the operations of the survey party under my charge, engaged in laying out additional lots to the north of Gorham township, viz.. concession 7 and the western portion of concession 8 for agricultural purposes as per your instructions dated 14th April, 1913.

As instructed the north boundary of the township was re-run and chained, and posts planted at 40 chains west of the old meridians and marked for the north concession only. The retracing of the old lines was a very difficult and tedious undertaking, the original survey having been made 21 years before. Where the chainage showed an unusual discrepancy from the old notes these distances were checked by another set of chainmen. The production of the old blazed meridians northward likewise did not turn out quite satisfactory. In future work of a similar nature I would suggest running the meridians south from the new standard con-

cession and having the inevitable small jogs on the old concession line. The survey was commenced as advised, by running a line due north from about the centre of the township—the north-east corner of lot 9, concession 6, on the old survey—80 chains, and thence east and west astronomically across the township, along concession 8. An iron pipe was planted here as well as at each end of this concession. Small iron rods or pipes were also planted where the wagon road crosses the 6th concession, and the east boundary of lot 3, concession 7, as shown in field notes.

The land on the extreme eastern limit is very rough and rocky, but improves as we go west and doubtless much of it will be eventually taken up by those hardy and industrious pioneers of settlement of Finnish origin, who are making a success of their holdings in other parts of Gorham and Ware townships. A clearing has been started on the north half of lot 2, concession 7, adjoining the wagon road by a Mr. Dufault, who stated his desire to obtain and cultivate the same. The soil is sandy throughout with vegetation more abundant in the valleys of the numerous streams and lakelets. Some streams have been dammed by beaver, forming lakelets of flooded land which will likely revert eventually to the former river dimensions. As will be noticed on the plan the raising of the level of Hazelwood lake for Hydro-Electric purposes at Port Arthur has greatly enlarged the area, around the shores of which in concession 7 a road allowance has been provided for. Onion lake which has likewise been greatly enlarged for storage for Hydro-Electric purposes at Port Arthur, lies about ¼ mile north of lot 1, concession 8. Surprise lake on lots 14 and 15, concession 7, and 14, concession 8, in a prominent lake, 2 miles in length, abounds in pike and lies on the winter highway to the north-east arm of Dog lake. The waters of all these lakes are at times rather warm and of a slightly brownish tinge.

There is also Trout lake, one mile in length, on the western end of concession 7 and partly in the township of Ware, which, owing to its favorable sandy sloping beaches is being sought after as a summer resort. The trout here seldom attain any appreciable size owing to the close attention of sportsmen and others. A road less than two miles in length of easy grade would connect this beauty spot with the excellent Government road to the south admitting of rapid motor connection with the cities of Port Arthur and Fort William.

Another lake is Pike lake, ¾ of a mile in length on the north of lots 9 and 10, concession 7. A deserted shaft and forge indicated that this had been worked as a mining claim (gold?). It was surveyed long ago as 233 T.

I might here remark that our survey was entirely in the Huronian formation, the only other rock noticed being an outcropping of intrusive granite near the west end as shown in the notes. There were no visible indications of economic minerals and no unusual variation of the magnetic needle.

The timber plan submitted herewith shows the very mixed character of the forests. It would be difficult to note any particular area where any considerable quantity of merchantable timber prevails apart from the other varieties, which mentioned in order of precedence I would rank as follows, spruce, poplar, birch, jack pine, tamarac and balsam. The prevalence of windfalls indicate that fires have swept the greater portion of their area within the last 40 years.

The game in this region consists of the usual moose, deer, partridge, rabbit, duck, bear, porcupine and beaver, the latter of which are being recklessly slaughtered and will soon disappear unless there is a more stringent enforcement of the game laws. The sowing of wild rice as an encouragement for the ducks and restocking the lakes and streams with trout, which, in the past have been abundant, should prove a benefit.

Owing to the almost unprecedented rainfall of last spring and summer as well as the more attractive work on the colonization roads in the vicinity, it was almost impossible to induce the settlers to work on our survey party even at $2.50 a day and board. Appearances are that labor will be much cheaper the coming season.

As I had previously traversed the Current river for the City of Port Arthur, I was enabled to save the expense of a survey of that difficult portion.

The survey work in this township was approximately as follows:

Miles of lot line run	32½
Miles traverse of lakes, etc., chained	8
Miles pacing and topography	5
	45½

also cutting several miles of portages.

I have the honour to be, Sir,

Your obedient servant,

(Signed) A. L. Russell,
Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines.
Toronto, Ont.

Appendix No. 33.

Survey of Part of the Township of Ware, District of Thunder Bay.

Port Arthur, March 17th, 1914.

Sir,—I have the honour to submit the following report on the survey of concession 7 and part of concession 8, north of Ware township during the past year.

The conditions here are very similar to those prevailing north of Gorham township, the country, however, is not so broken up by lakes.

The soil in the eastern portion is sandy but changes to a clay in lot 7, which continues westward to the Kaministikwia river where rock is more in evidence than elsewhere. The better land lies in the eastern half adjacent to Gorham township and some good land will be found north of concession 7 along the river. Very little swamp was encountered.

Many of the lots will doubtless be located by those hardy and thrifty pioneers of Finnish origin who are settling upon the lands to the immediate south.

As shown on separate timber map the usual mixed spruce, birch, jack pine, poplar, tamarac and balsam abound. A considerable area of large timber exists in the western portion of concession 7 and several winter roads have been cut connecting therewith. Some of the good timber has already been taken out.

There were no visible indications of minerals of economic value and, except where there is intrusive trap rock at the Crooked rapids. As usual variation of the magnetic needle was noticed.

WATER POWERS.

A fall of fifteen feet in a few chains in the Kaministikwia river at this point may eventually be developed for water power purposes owing to the beneficial results of the controlling dams now in operation at Dog lake. The right-of-way for the transmission line from the Great Dog falls to Port Arthur should also be reserved in patents, as the survey operations of last year at this point indicate an early development of this valuable power for the benefit of the twin cities at the head of the lakes.

As Trout lake, as previously reported, in attracting attention as a probable summer resort and lies partly in this township, I might refer again to the advisability of reserving the adjacent lands for that purpose. As mentioned easy access can be had thereto for campers and settlers by connecting with the Government Road two miles to the south.

The western end of the township can be reached by the wagon road leading from the Canadian Pacific and Grand Trunk Pacific Railways at Kaministikwia, also by boat in the river.

The new order, re taking agricultural or mineral (timber?) locations, conditionally, might with advantage be applied to this township.

I have the honour to be, Sir,

Your obedient servant,

(Signed) A. L. RUSSELL,
Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 34.

SURVEY OF THE TOWNSHIP OF O'BRIEN, DISTRICT OF TIMISKAMING.

NEW LISKEARD, April 11th, 1914.

SIR,—In accordance with your instructions bearing date July 4th, 1913, to survey the township of O'Brien, I herewith present my report.

The soil in this township is apparently of good quality; in clearings made along the right-of-way, during the construction of the Transcontinental Railway, an excellent growth of timothy was seen, and the fire rangers at Kapuskasing river had fine vegetables. I believe that there is no part of the township, that will not be fitted for agriculture, though part of it will require drainage, particularly away from lakes and rivers. One thing observed was the high spring flood marks on the trees along the Kapuskasing and Woman rivers, one result being that in places where the land runs back level or with a gradual slope from the banks, it is submerged during the spring freshet. With the clearing up of the country these floods will be more severe.

With regard to timber, that along the rivers and watercourses is of fair size, some of it running up to 18 and 20 inches in diameter, most of it spruce with considerable balm of gilead and a sprinkling of birch and poplar, where the land is fairly dry. Away from the rivers, the timber is mostly small and will be useful only for pulpwood, the swampy condition of the land has no doubt something to do with this, and it cannot I think be laid to any defect of the soil.

This township will hardly likely be noted for its mineral production, there are no rock exposures except on points along the Kapuskasing river and at the falls on Woman river, and no traces of minerals of economic importance could be discovered in these exposures.

Upon the fishing, I am unfortunately not able to speak with authority, except in so far as the Kapuskasing river is concerned. We placed our net in this river but after several days succeeded in catching nothing but a few suckers. The rivers and streams of this township are of a muddy color and it is quite unlikely that fish will be found in them to any extent. I am told by the Indians that there are plenty of pike and pickerel in the lakes of this township of which there are several, the chief being Lily lake. This I was not able to confirm for on removing the net from Kapuskasing river it was found to be in such a condition from weeds and driftwood that it was impracticable to use it again. The lakes I have referred to are very pretty but are inaccessible, except on foot.

Moose are plentiful here as they are in all this section of Timiskaming. Several bears were seen and one of my men saw a red deer. Of other game and fur-bearing animals no traces were seen, but I understand from the Indians and trappers that I saw, that this is a good township for fur.

The National Transcontinental Railway passes through this township, entering it about midway on the east boundary and continuing in a north westerly direction. It crosses the westerly boundary of the township about one and three-fourths miles from its north-west angle. There are two railway stations within its borders, one at the Kapuskasing river and the other about a mile from the east limit of the township.

Observations were taken at regular intervals as ae shown on the observation sheet accompanying this report.

Sixteen iron posts supplied by the Department were planted as follows:

(1) On the south boundary of the township at intersection between lots 6 and 7.

(2) At south-west angle of lot 18, concession 1.

(3) On the east boundary at intersection between concessions 2 and 3.

(4) At south-west angle of lot 6, concession 3.

(5) At south-west angle of lot 18, concession 3.

(6) At south-west angle of lot 28, concession 3.

(7) On east boundary at intersection between concessions 3 and 4.

(8) At intersection lots 6 and 7, concessions 3 and 4.

(9) Intersection lots 18 and 19, concessions 3 and 4.

(10) At south-west angle of lot 24, concession 7.

(11) At south-west angle lot 6, concession 9.

(12) At south-west angle lot 6, concession 11.

(13) At south-west angle lot 18, concession 11.

(14) At south-west angle lot 28, concession 11.

(15) At north-west angle of lot 6, concession 12.

(16) At north-west angle of lot 18, concession 12.

There was one post supplied in addition to those just enumerated, but it was unfortunately lost and I was unable to replace it.

The total area of the township is 51,970 acres, made up as follows:

Land in lots	49,413 acres.
Land in roads	1,040 acres.
Railway lands	164 acres.
Water (including islands)	1,353 acres.

All of which is respectfully submitted.

I have the honour to be, Sir,

Your obedient servant,

(Signed) C. H. Fullerton,

Ontario Land Surveyor.

The Honourable the Minister of Lands, Forests and Mines,
Toronto, Ont.

Appendix No. 35.

Supplementary List of Licensed Cullers, 1914.

(For complete list of cullers see Minister's Reports, 1911, 1912, 1913.)

Name of Culler.	*Post Office.*
Gordon, J. B.	Cache Bay.
Mathewson, O. R.	Blind River.
McCool, Daniel.	Sudbury.
Palmer, Fred.	Blind River.
Skead, Eric S.	Spanish Mills.
Sullivan, Michael.	Barry's Bay.
Swale, Wm.	Gillies Depot.

Appendix No. 36.

Algonquin Provincial Park.

Honourable W. H. Hearst, Minister of Lands, Forests and Mines:

I beg to hand you my report on Algonquin Provincial Park for the fiscal year ending 31st October, 1914.

Up to the time the deplorable war broke out Algonquin Park was the pleasure resort of a great number of people coming from all parts of the world, including Russia, China and Japan. Mr. Vladimir J. Generosoff, senior specialist of the hunting industry of the Department of Agriculture, St. Petersburg, Russia, was

sent here by the Russian government to study our methods of game protection and the management of game and forest preserves. As soon as war was declared most of the visitors were called home, and even here in the heart of our Canadian woods its blasting effect was felt. Orders for live animals, of which we have had a number, were all cancelled, and owing to the general depression and the fall in the price of furs it was decided not to take any pelts this winter. This, of course, very materially lessens the income from the Park, yet notwithstanding these facts we collected for fishing licenses, $1,249.00; Live Animals, $1,112.50; Rents, $270.00; Furs, $300.00; Cedar Timber, $679.90; Fines, $20.00; making a total of $3,629.40. The cedar sold was to the Grand Trunk Railway for the construction of their summer camps on Big Island lake, which were completed in time for the summer's trade. This camp can comfortably take care of a hundred guests and while the cottages are most homelike they have every convenience, the sanitary arrangements are the best, and the entire camp is lighted with gas.

We seem to have fewer anglers and more who come for the sake of the life in the woods and the health to both body and mind to be derived from such a life. I feel that the Park is doing a good work as an educator of our people who are learning to enjoy a visit with the wood folk in their natural haunts more than the destruction of them. Fur-bearing animals have become very abundant, especially beaver and otter. Deer are plentiful and can be seen by all visitors with little trouble; in fact so tame have they become that they feed on the terraces in front of the hotel, and some good photographs have been taken of them there.

It is now recognized that owing to the increased demand and the steady encroachments which civilization is making on the waste places of the world inhabited by fur-bearing animals, a large part of the fur supply of the future must necessarily be got from animals bred in captivity or under control. Fur-farming is rapidly coming into favor, and the astonishing development of the black fox industry in Prince Edward Island has shown it to be capable of yielding large profits. The Department has thought proper to give Ontario fur-farmers an opportunity of obtaining such fur-bearing animals as are found in Algonquin Park in order to stock their ranches. These include beaver, mink, marten, fisher, otter, etc., but principally the first three. Special appliances have been devised for capturing the animals without injury or mutilation. The live animals sell for considerably higher prices than do the furs, since their capture and care involves not a little trouble and expense. Nevertheless, a fair revenue can be derived to offset the cost of administering the Park, and at the same time run no risk whatever of depleting the supply of fur animals.

A large cement building has been erected at headquarters to take care of live animals. It is 22 x 42 feet, all of cement with iron roof and iron partitions, and is supplied with running water and lit with gas, the work being done by our own men. The object of this is to keep the animals after capture till they become accustomed to being handled and fed before shipment, and to afford the hundreds of visitors to the Park an opportunity of studying the different animals. During the winter we hope to fill the pens with mink and marten, mostly the latter, and we hope next summer to have raised a number of young for shipment. The old animals will also be shipped to make room for others.

Complying with your instructions the wharf petitioned for by the campers was built and proved a great convenience. It is a floating wharf, built of sided cedar, and covered with two-inch plank.

There are sixteen summer cottages on Cache lake and two schools. The cottagers pay a land rental of from $7.50 to $15.00 according to the size of lot held. The schools pay a rental of $75.00 for five acres. The boys' school is presided over by Prof. G. G. Brower of New Jersey, the girls' school of some fifty odd girls is under the care of Miss F. L. Case of Rochester, N.Y., and is, I believe, the model camp of America. On Lake of Two Rivers there is another camp, the Bordentown (N.J.) Military Institute, under the management of Prof. W. L. Wise. These camps are a splendid thing for the young people. I regret none of our Ontario people have taken this work up, financially and from an educational point of view it offers great inducements. We expect to have another such camp at Source Lake next year. Fishing during the past year has been good. Some fine specimens were taken: one fine salmon trout caught in Smoke lake by Lady Conan Doyle has been mounted and sent to her home in England. Nearly all the prizes offered by sporting journals won this year were taken by fish from Algonquin Park. A number of fingerling bass were put into Cache lake; they were in splendid condition when planted. I should like to see some more next year, also salmon and speckled trout, as it is important to keep the lakes near the hotels stocked, so that those who are not able to go far afield can have some sport.

I regret to have to report several bad fires, which although they did not destroy a great deal of valuable timber, ran over a large territory, a great deal of which had been burnt over some sixteen years ago. Of course the young growth was destroyed. Every possible effort was put forth to check these fires, but the continual dry weather and high winds constantly from the same quarter, made it almost a hopeless task. In nearly every case these fires were caused by the engines of the Grand Trunk Railway. It would almost seem necessary to make it compulsory to burn oil in the engines running through the Park. One year's loss would convert the engines into oil burners.

As instructed by you a gang of fifteen men and a team were last August put to work to clean up the debris on the right-of-way and for some distance into the woods on each side, the Grand Trunk people paying half the expense. A splendid job was made of it and the work continued until late fall, when the snow stopped it. I would strongly recommend the continuance of this work next spring and until the entire length of the railway within the Park limits is cleaned up. It will very materially lessen the danger from fire. I would also recommend building a telephone line along the railway through the Park a distance of some forty miles. This would cost in material between $500 and $600. The expense of putting it up would be very small as the work could be done by the Rangers. We now have telephones at headquarters and Joe Lake, and also have connection with Smoke lake eight miles to the south and Island lake ten miles to the north, using the wires of the Grand Trunk. These phones were of great assistance during the fires. With a phone in each shelter house between Rainy lake and Whitney our men could get in touch with headquarters quickly and report help wanted, etc. I think the Grand Trunk Company would not object to our using the poles along the railway for this purpose.

We had two bad fires on the limits acquired by the Government from the Munn Lumber Company. A great part of the section burnt over was old burn and slash, but some small pine was also injured. This was put up for sale, but owing to the great depression in the lumber business no offers were received. The hardwoods were not badly burnt, and I think in most cases will revive, it being

a leaf burn, that is to say, it burnt so rapidly with the high winds that it did not burn deeply. We had five shelter-houses burnt, three of these were old ones, and needed replacing, but two were good buildings.

The time of our men during the summer was taken up fighting fire and we had to hire a great deal of extra help to build two new shelters, a frame building at Mud lake to replace one burnt, and another a sided log building on Moose lake. These are both substantial edifices. Several portages were cut out. During the trapping season our men are kept patrolling the sections allotted to them and I feel that they have done good work. I am glad to report very few breaches of the law, and what there were did not constitute serious offences. A number of guns were confiscated and sent to Toronto, mostly taken from foreigners on the construction work of the Canadian Northern Railway.

There is not much lumbering going on in the Park this year. Mr. J. R. Booth has a small camp in the new section cleaning out a little that was left from last year, and McLaughlin Bros. of Arnprior are taking out some on the burnt section. Lumbering is, as a rule, very quiet all over the Province.

The Canadian Northern Railway which runs through the northeastern portion of the Park is well on to completion, and work trains have been running over it for some time from North Bay. This railway follows most of our large lakes in the north section and the Petewawa river and Grand lake in the new section. It will be a very popular road with the angler as the lakes and rivers in that whole section are full of the finest speckled and salmon trout.

Eight townships were added to the Park this year, namely: Edgar, Barron, Guthrie, Master, Stratton and Bronson, half of Fitzgerald, White, Niven and Clancey. I have visited these during the past year; they are mostly covered with a young growth of red, white and grey or Labrador pine (*pinus divaricáta.*)

A supply of permanent metal signs for indicating the boundaries of the Park was received from the Department. These will be nailed to trees on the boundary lines, especially at points where they are crossed by trails, creeks or rivers; also on all boundary lakes, thus giving notice to all travellers or other persons interested when they enter the limits of the Park.

Deer are numerous all over the new section and beaver, mink, marten, etc., are still in evidence, notwithstanding this section has for years been heavily trapped. We secured a building at Basin Depot from Mr. M. J. O'Brien, the limit-holder, and fitted it up for a shelter-house. The four settlers who had squatted in the township of Guthrie have been satisfactorily settled with, and are leaving their places. I would recommend giving the ranger at Basin Depot a saddle horse, as the country is so open and traversed by so many roads he could quickly do the work of two or three men with a horse, and could come out quickly in case of help being required in case of fire. The total cost would not be more than $70, and as there will be abundance of hay there, there would be no cost attached for feed; there will, of course, be stables and all the buildings we require when the settlers move out. One has already gone.

The Pembroke Lumber Company's limits have also been acquired by the Government and constitute another large tract upon which there is a lot of young pine growing for the people of Ontario.

Our staff has been composed of Superintendent and twenty-six men. I feel that our men have done good work, although it has without doubt been the worst year for fires since the establishment of the Park, and had not a great effort been put forth on the part of our rangers, a great deal more territory would have been destroyed.

Wolves are still a menace to our deer, our men succeeded in killing a large number of these pests and we propose during the coming winter to make a special effort to materially reduce their forces.

I have the honour to be, Sir,

Your obedient servant,

G. W. Bartlett,

Superintendent.

Appendix No. 37.

QUETICO PROVINCIAL PARK.

QUETICO PARK HEADQUARTERS, KAWENE P.O., October 31st, 1914.

To the Honourable the Minister of Lands, Forests and Mines, Toronto, Ontario:—

Sir:—I beg to hand you my report for the fiscal year ending Oct. 31st, 1914, on the Quetico Provincial Park, of which I have the honour to be Superintendent.

I took charge of the Park in November, 1913, when it was transferred from the Department of Game and Fisheries to the Department of Lands, Forests and Mines.

At the time of transfer I found buildings as follows: A small house at north-west end of Eva lake, one and one-half miles from Kawene station on the Canadian Northern Railway, occupied at the time by Col. D. D. Young, warden in charge of the Reserve. This building was some six miles from the headquarters at French lake. The headquarters are situated at the east shore of French lake at the west end of what is known as French Portage on the old Dawson route from Port Arthur to Winnipeg.

The buildings at headquarters were a large log hut, 21 x 47 feet, a portion of which was partitioned off for a kitchen. the balance being used as a sleeping and living room for the men employed on the Reserve. A small cabin of two sections 12 x 14 each, was used as a warden's house; there were also a good storehouse and stable combined, 16 x 24, also several small temporary outbuildings.

I occupied the small cabins during last winter and portion of past summer until I could erect a proper house for myself. During the past season I built a house 26 x 36 of sided pine logs, with good roof of tin shingles, good basement, full size of the house, with sided cedar wall, all of the basement is below the surface of the ground. I placed in the basement a good furnace enclosed in a stone room 12 x 12 feet for protection from fire.

I also changed the men's apartments by building a kitchen at one side 17 x 21 feet, and converting the old kitchen into a comfortable dining room. I also put in a floor in all of the large buildings, and purchased iron cots and mattresses for the men. This year I had the whole of the buildings plastered with mortar.

I erected a small stable 16 x 20, a small frame blacksmith shop, and two small out-buildings. The building used as stable and storehouse I had cleaned out from top to bottom, put in a new sided top floor and transformed it into a tool and provision storehouse. I intend during the winter season to erect an ice house, which is very necessary. During the summer season we have to depend on getting our drinking water out of French lake, which contains good clear water.

I also built a good shelter hut on Eden island in Quetico lake, one at Johnston's Point on Basswood lake, one at Darby's Island at the east end of Basswood lake, and one at the foot of Pickerel lake. The old shacks at Eden island and Basswood lake were unfit for habitation. All new huts built are 16 x 20 feet of hewn and peeled logs, with pitch roof covered with paroid roofing, well floored, and contain bed, stove, table and benches or stools. They are made warm and comfortable, and are kept clean by the men. I also had repaired old shacks at Sturgeon Narrows, lake LaCroix and Kinmipi lake. Will also erect this winter small huts at Robinson, Beaverhouse and Cache lakes. These huts are for use over night and during short periods that the rangers may be in the vicinity, and also to avoid having to carry tents when on patrol.

It is very difficult to get in supplies and building material to the Park during the open season. The road over the portage one and one-half miles from Kawene station to Eva lake is very rough. I built a barge on Eva lake to transport my horses and supplies to and fro. The portage over which we pass from Eva lake to French lake is twenty-seven chains in length over a very high hill.

Owing to my time being taken up during the summer with building operations and travelling over the several beats, erecting shelter huts, etc., I did not succeed in looking over the ground on the portages out to the station, as I intended, with a view of securing a better road, but will do so as soon as possible. I cut a new winter road from French lake to Eva lake by way of Brown's lake, so as to avoid a long round by the summer route and also avoid portaging at open narrows. I cut trails from French Portage to Windigoostigwan lake one and one-half miles, and one from Windigoostigwan river to Baptism lake, two miles, Baptism to Cache lake, three miles, also from Pickerel to Jessie lake and from Basswood lake to Small Inland lakes. At Eden Island the two rangers stationed there have cleaned out several old trails besides cutting new ones from Quetico and Beaverhouse lakes to inland points. The Park staff during the past year has been composed of eleven men, one of whom came on lately, a superintendent and a housekeeper. During the trapping season the work of the staff is in patrolling the sections over which they have charge to prevent illegal trapping and hunting as well as other breaches of the Park laws.

My men travel in pairs; when building huts four go together until the heaviest of the work is done, when two go on patrol. In many cases the area covered contain many water stretches and are easy of access, although in some portions many portages are encountered making travel, especially during fly season, very bad. I feel that I have a good staff and that they have done excellent work during the past season, when it is considered that they had to undergo many hardships in getting things into shape, did without shelter huts or trails, and had to portage outfits and supplies through snow and over rough ground. I fully realized when I came here that we had lots of hard work to do and expect much more before we can get things in proper shape.

I do not consider that much illegal trapping was done last season. We picked up some steel traps along the boundaries and destroyed several dead-falls, presumably set by Indians. As it is now well known by outside trappers and Indians that the Park is patrolled by rangers at all seasons there is not likely to be much trapping or hunting done. I have instructed my rangers not to relax their vigilance and not to hesitate to arrest anyone whom they find breaking the Park laws. I have warned them especially in regard to American Indians coming across the border to trap in Canadian territory, but to endeavor to keep on good

terms with our Canadian Indians. It is a difficult matter to distinguish between Canadian Indians and those from the American side. Some of them claim to belong to both sides and to draw treaty money from both Governments, and unless personally known to the rangers they pass themselves as Canadian Indians. There are no Indians at Reserve No. 24-C near the eastern boundary, but quite a few on Reserve 25-D at the mouth of the Namakan river. They do not seem to cultivate any portion of the Reserve, but subsist by hunting and fishing. I endeavored last summer to engage two of them as fire rangers but could not do so; they do not seem inclined to work.

I am pleased to inform you that the season has passed without any serious fire in the Park. One small fire occurred on a small island in Elprior lake and one along the southern boundary, both of which were extinguished before any damage was done. Another fire occurred at Johnston's Point on Basswood lake. This fire was started by some unknown person or persons during the month of August in the place where rangers Johnston and Darby did their cooking while erecting a shelter hut on the point. It is supposed these parties went off leaving the fire burning. The rangers were absent at the time up Basswood river. Returning they noticed the fire but could not get it under control until the newly erected walls and roof of the hut were destroyed. They were fortunate enough to save their blankets, provisions, tools, etc., by taking them to the water. About ten pine trees only were burned. They had to rebuild the walls of the hut.

My men during the summer months take every precaution to prevent fire by constantly patrolling their beats and looking after tourists, of whom quite a few passed through the Park last season. So far we have not experienced any trouble from tourists. They are in all cases provided with copies of the Park regulations, and we give special warning in regard to fire. In addition to our regular staff we had eight fire rangers on duty during most of the season.

In regard to the timber in the Park, it is chiefly red, white and jack pine, of excellent quality, and in immense quantities, especially white pine. The balance of the timber is spruce, balsam, cedar and birch. Most of the hills in the eastern portion over which fire ran some years ago, are covered with scrub spruce and jack pine, making an excellent shelter for game of all kinds.

The red and white pine in the vicinity of Jean, Quetico and Beaverhouse lakes and in several other portions of this Park is wonderful; as an old bushman I must say that I have never seen any timber to equal it. The Province has an asset worth protecting. The natural waterways of the Park as well as the splendid lakes of clear water will, in time, make it an ideal summer resort for tourists.

Many tourists passed through the Park last summer, mostly Americans, but some from Brandon and Winnipeg, Manitoba. Some parties have requested the privilege of building cottages or leasing portions of land for summer resorts. This I would not approve of except in localities near headquarters, or in places where there is no valuable timber. I would advise keeping the Park in a state of nature as much as possible.

I would advise an extension of the Park boundary to the North by taking in that section of country commencing at a point where the boundary line between the districts of Thunder Bay and Rainy River crosses the Canadian Northern Railway, thence following the line of railway westerly to a point east of the village of Atikokan, opposite the northeast corner of Timber Limit G-43, thence southerly along the east line of said limit to where it touches the north shore of Batchewaung lake, thence following the present boundary west from there. In this terri-

tory are many small lakes, some of which are not shown on the maps, and many containing great quantities of trout. It is also the resort of many moose and red deer, as well as smaller game animals.

Moose are very plentiful, great numbers of them being seen during summer, French lake, French river, Pickerel lake, Maligne river, Quetico lake and river being the principal places where moose abound. Several came on the beach and in the bay opposite the buildings last summer. They are now all in the hills north of French and Pickerel lakes. Many moose calves were seen also during the season. Red deer are numerous. Many were seen during summer along the shores of lakes and rivers. Partridges are scarce. I am inclined to think this is on account of the numbers of foxes, coyotes and skunks in the woods. Coyotes are very numerous. Wolves have often been seen; tracks of these animals are often noticed on the ice in winter. I am encouraging my men to poison them when possible. One of my rangers got one on the Maligne river last winter; in several cases bait was taken also. This season we expect to be in a better position to get them.

Beaver are increasing rapidly: where only one house or pond was to be seen last year many are now seen. Mink are often noticed in the streams. Some otter trails were observed last winter. I have not yet seen any muskrat or signs of them. Weasels are plentiful. Bear signs are very numerous. Two moose calves were killed by bears in June last at Pickerel lake.

The lakes are well stocked with trout, pike, pickerel, whitefish, and some other varieties of fish. Only in two lakes in the south are bass to be found. There are no speckled or brook trout in the Park. I would strongly urge the placing of speckled or brook trout and bass in some of the lakes and rivers near headquarters. The lakes and rivers are clear and clean, ideal breeding places for trout and bass. Ducks are very scarce. A few of the eatable varieties were seen in spring and early summer, but disappeared later on. Sawbills and other fish-eating varieties were the only ones remaining all season. There are no feeding grounds for them in the lakes. If wild rice or celery were placed in some of the lakes, I have no doubt many more ducks would breed and remain in the district.

Owls are very large and numerous in the Park. I shot two large hawks on a nest last spring and found several portions of partridge and a portion of a young fawn. I have advised my rangers to kill and destroy owls and hawks whenever possible. Another menace I see in the Park is the porcupine. In many places I have noticed pine trees girdled by those animals, noticeably so in the pine hills on Eden island and along Pickerel lake. I would advise killing off these animals, especially in pine forests.

During the present winter, or as soon as the ice is fit for travel, it is my intention to go over as much of the Park as possible and see for myself some portions of the interior not yet visited, locate sites for new shelter huts and portages, and obtain as far as possible an idea of the lie of the lakes and streams, kinds of timber, etc. This travelling must be done with snowshoes and toboggans, taking tent, provisions and blankets along. I find it is impossible to obtain a dog team in this country.

I have the honour to be, Sir,

Yours very respectfully,

A. J. McDonald,

Superintendent.

Appendix No. 38.

Report of the Forestry Branch.

Parliament Buildings, Toronto.

Sir,—I have the honour to submit the following report of the Forestry Branch for the year ending 31st October, 1914.

The work of this branch has been devoted largely to questions of reforestation. The Provincial Forest Station in Norfolk County, which was established in 1908, now contains 1,580 acres, of which about 50 acres are devoted to Forest Nursery work.

The Forest Nurseries at this station now contain the following stock:—

White Pine	409,000
Scotch Pine	205,500
Red Pine	137,280
Jack Pine	101,400
Bull Pine	19,100
White Cedar	47,000
Hard Maple	18,000
Soft Maple	20,000
White Ash	22,000
Black Walnut	9,620
Black Locust	5,000
Red Oak	5,000
Carolina Poplar	7,250
Black Cherry	2,850
Miscellaneous	96,600
Net Total	1,105,600

A portion of the nursery stock grown here is used for distribution throughout the province to those desiring to make forest plantations or reclaim waste land. During 1914 over 400,000 plants were sent out to other parts of the province for experimental or demonstration planting.

This nursery also provides the planting material for experimental work at the local Forest Station. During this last season 50 acres of various types of land were planted. Plantations have been made with White Pine, Red or Norway Pine, Scotch Pine, Larch and Chestnut.

Forest planting will, to a large extent, be done upon the poorer, non-agricultural soils. The coniferous trees, and especially the pines, have proven the most satisfactory for such planting. In the next few pages a brief description is given of the operations of nursery work and final planting, as carried on at the Norfolk Forest Station.

Artificial reforesting is done by broadcast sowing of seed, by planting the seed on prepared spots and by the use of nursery grown plants. Planting with nursery grown stock has largely replaced methods of direct seed sowing. This is especially true of such species as our native pines.

Forest seeds may be obtained from dealers or collectors, and are satisfactory if the origin of the seed is known. White pine seed may be obtained at prices

ranging from 75 cents to $2 50 per pound. Red or Norway Pine may be obtained at prices ranging from $4.00 to $7.00 per pound.

Seed beds are made four feet wide and thirty feet long, with a protective covering as shown in Fig. I. This lath screen, giving half shade, is raised twelve to eighteen inches above the beds, and is required to protect the seedlings from the excessive summer heat.

Seed may be sown in autumn, or in spring as soon as the growing season opens. The seed may be sown broadcast or in rows. The method followed at the Norfolk Nursery is to sow in rows about four inches apart. The depth of covering the seed depends upon the nature of the soil. One-eighth to one-quarter of an inch should be satisfactory, but this is largely a question of being able to keep moisture at the surface during the germination of the seed. Evergreen seeds will take from fifteen to twenty-four days to germinate.

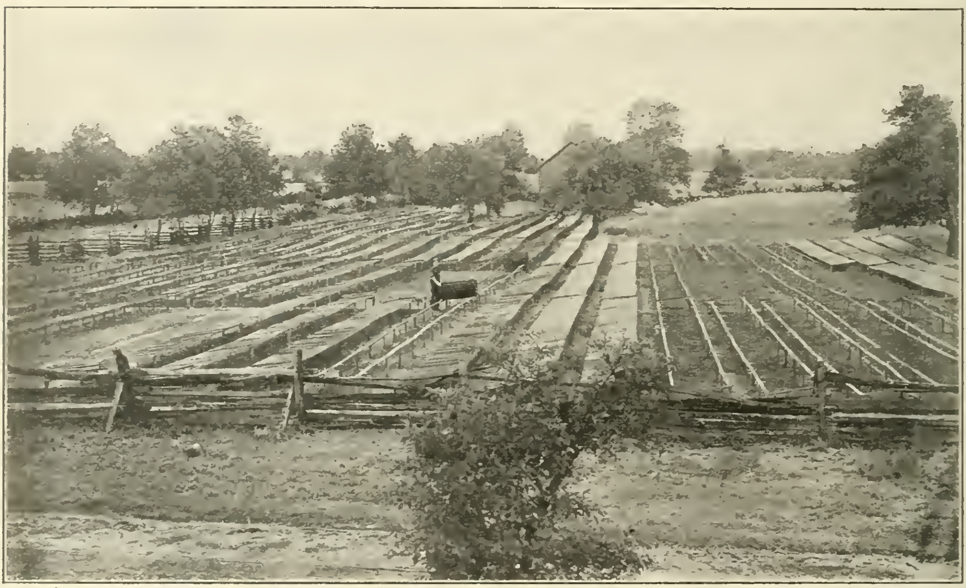


Fig. I. Showing view of seed-beds at the Provincial Forest Station, showing use of woven lath screen.

The chief difficulties to be met are attacks by birds, as the plants are just showing; sun scorch from allowing the ground to dry out too much or through lack of shade, and attacks of "damping-off" fungus, which is often troublesome during hot sultry weather when there is too much moisture in the soil.

The seedlings are usually left in the seed-beds for two years. The protective screens may be taken away at the end of the first season. At the end of the second season the White Pine plants are three to five inches high and are ready for transplanting to nursery lines as shown in Fig. III. This transplating prepares the plant for final planting, in that it produces a stocky plant with a compact root-system, as shown in Fig. IV.

In some cases the one or two-year old seedling is used for final forest planting without this special preparation. For planting upon favorable soils, where protection exists and where the struggle is not too severe, the one-year old Scotch Pine or the two-year old White Pine seedling may be used. In much of the forest plant-

Fig. II. Showing two-year-old White and Red Pine in seed-beds, with shades rolled back.

Fig. III. Showing transplanted Scotch Pine in nursery lines. This material is ready for final planting upon waste lands.

ing being done by this branch, where exposed sites are being planted the sturdy transplant is desirable.

In forest planting two men usually form a working unit. One man prepares the hole with the mattock or spade and the other sets the plant. The plants are usually carried in pails half filled with water. This is done to prevent drying out of the roots and is a very necessary precaution. Where the planting area is covered with turf and not too rough, it is often advisable to make a shallow furrow with the plow as shown in Fig. V. The plants are spaced from five to six feet apart each way. At five feet apart an acre requires 1,742 plants. In forest planting it

Fig. IV. Showing three-year-old transplants of White Pine (on left) and Scotch Pine ready for final planting.

is necessary to plant many more trees than will eventually be found in a mature forest. If trees with clean, tall stems are desired, it will be advisable to plant close, in order to kill off the side branches and force the trees in height growth. Close planting also gives earlier soil protection, preventing the growth of grass and weeds.

It has been found that three-year old White Pine transplants ready for final planting cost about $3.50 per thousand. In planting gangs of ten or twelve men the men should average 1,200 plants per day. Based upon these figures the following

Fig. V. Showing the use of shallow plow furrows in forest planting.

Fig. VI. Planting forest trees with mattock where ground is rough and stony and unfit for use of plow.

is an estimate of the cost of planting upon favorable soils as found at the Norfolk Forest Station:—

One acre, planted 5 x 5 feet, requires 1,742 plants.

Cost of 1,742 plants, at $3.50 per 1,000	$6 10
Cost of labor in planting 1,742 plants, at $2.00 per day ..	2 90
Total cost per acre	$9 00

One acre, planted 6 x 6 feet, requires 1,210 plants.

Cost of 1,210 plants, at $3.50 per 1,000	$4 24
Cost of labor in planting 1,210 plants at $2.00 per day ..	2 02
Total cost per acre	$6 26

The cost of restocking lands such as are being dealt with in Norfolk, should not average over $8.00 per acre and with better organization this cost can be lowered. To plant cut-over and burned-over areas which exist in the central part of Ontario the cost will run from $8.00 to $12.00 per acre.

At the present time it is not feasible to undertake artificial reforesting upon the burned-over lands in the newer portions of Ontario. It will be necessary to have more intensive organization and better insurance against fires before this problem can be undertaken. When our people are fully educated to the necessity of protecting forest growth, the methods and technique of forest planting will be the least of our problems in restocking those denuded areas upon which natural growth of value has failed to reproduce.

In this connection it may be of interest to outline the life history of one or two of the typical northern trees. This will be done with the idea of explaining the methods of nature in producing forests. The life history of the White Pine will do for that class of trees known as Conifers or Evergreens.

White Pine trees begin to produce seed at from twenty to forty years of age. The seed is produced in cones, which are borne on the terminal branches in the upper parts of the tree. These cones are two seasons in coming to maturity. They mature at the end of August of the second year. The scales of the cone open and release the seed through the action of the sun and drying wind. All seeds of any value have fallen from the cones by the middle of September, and the empty cone may remain upon the tree for weeks or even months.

The frequency of seed years for White Pine depends upon climatic conditions and ability of trees to obtain plant food. Heavy seed years seem to occur through certain regions every five to seven years. In Southern Ontario large, healthy road-side trees frequently produce seed year after year.

One pound of White Pine seed may be obtained from one to two bushels of cones, depending upon the vigor of the parent tree and upon seasonal differences. One pound of seed contains from 25,000 to 30,000 seeds, depending upon the size and quality of the cones.

The seed of the White Pine is about one quarter of an inch in length and is provided with a thin, delicate wing, as shown in Fig. XI. The dry, warm winds of early September open the cones, releasing the winged seed, which is often carried a considerable distance before reaching the ground.

Owing to many enemies only a small proportion of seed reaching the ground ever germinates and grows. The seed is much sought after by birds, squirrels and mice. The plants produced by the small proportion of seeds which germinate after reaching the ground have still another struggle. The White Pine seedling is at first a

Fig. VII. Shifting sand at the Provincial Forest Station planted with Scotch Pine and Jack Pine in 1910.

Fig. VIII. The 1910 plantation as shown in Fig. VII after two seasons of growth. This photo was taken in 1912.

Fig. IX. Sandy ridge at Provincial Forest Station being planted with Scotch and Jack Pine in 1909.

Fig. X. The 1909 plantation as shown in Fig. IX after six years' growth. This photo taken in 1914.

delicate plant, as shown in Figs. XII and XIII. At one year of age it is only about two inches high with a delicate tissue. During this first season the young plant is subject to injury by parasitic diseases and sun scorch, and is subject to attack by birds. When two years old the seedling is only three to five inches high. Light ground fires, which apparently do little damage, destroy countless numbers of these small plants. For the first three years the growth of the seedling is very slow and it is subject to many enemies. It will readily be seen that under the most favorable conditions only a small percentage of the seed falling to the ground ever produces young pine large enough to be seen by the casual observer.

Another factor influencing the chance of obtaining reproduction of White Pine is the question of the vitality of seed. Pine seed under the most favorable condi-

Fig. XI. Showing White Pine cones. Mature two-year-old cones below and small one-year-old cones at tip of branch.

tions of artificial storage, soon loses its power to germinate and grow. Pine seed lying, under natural conditions, where it is subject to various changes of moisture and temperature would not be likely to grow after five years.

Some of the outstanding features in the life of the White Birch will do to show the ability of this class of trees to reproduce. The Birch produces its seed in a cone-like fruit, which often remains on the tree throughout the early part of the winter. Unlike the White Pine the seed does not all fall to the ground in early autumn, but gradually falls throughout the winter months. It is a common sight to see the small, winged seed of the birch being carried for miles on the surface of the snow. This is one factor explaining the prevalence of Birch on burned and cut over areas.

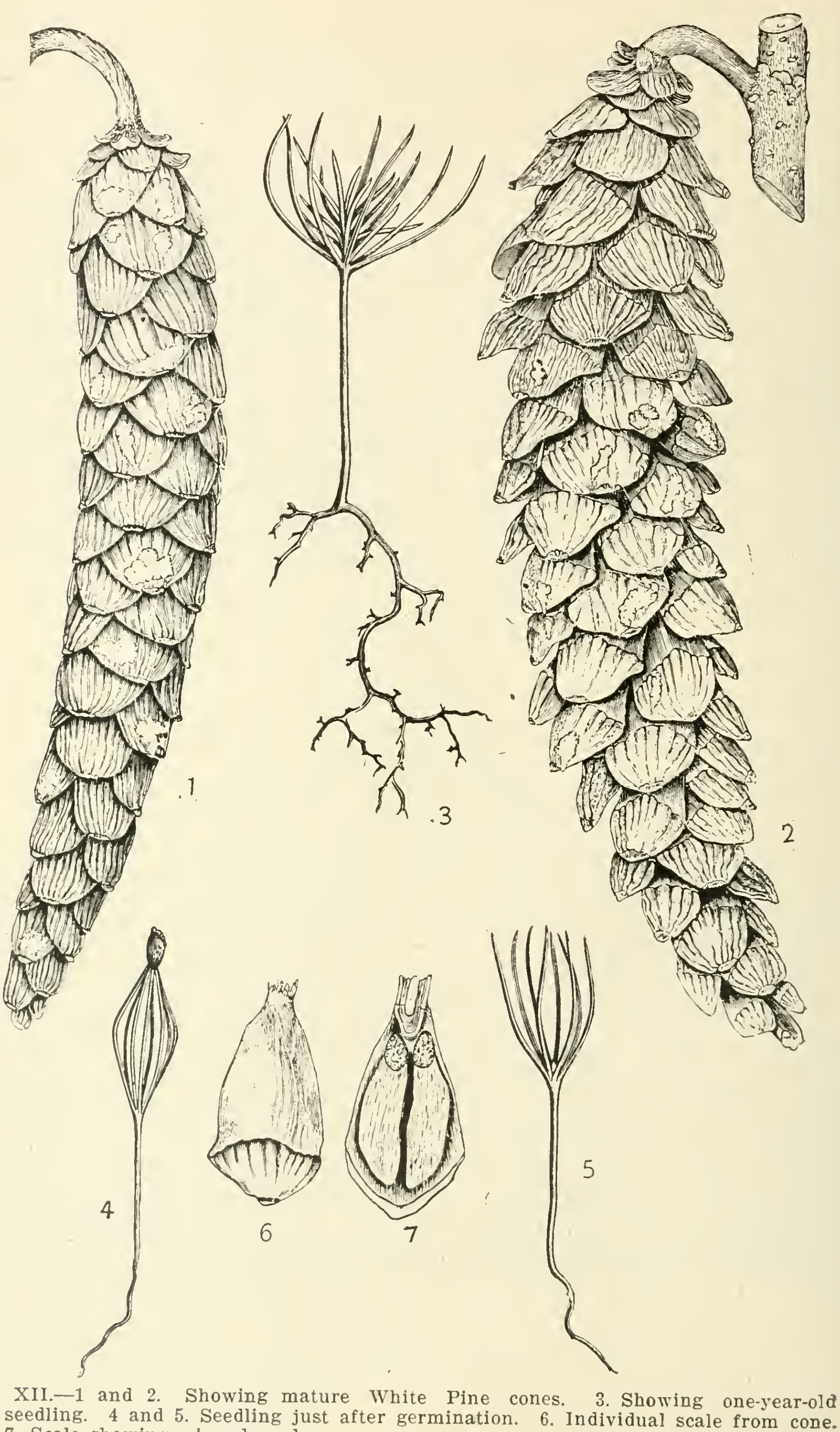


Fig. XII.—1 and 2. Showing mature White Pine cones. 3. Showing one-year-old seedling. 4 and 5. Seedling just after germination. 6. Individual scale from cone. 7. Scale showing winged seeds.

The Birches are also able to reproduce from the stump or roots. This sprout growth often follows light fires and cutting operations. The ability of Birch, Poplar and many of the hardwoods to reproduce by this method explains why many cut or burned over areas reproduce with Birch, Poplar and other hardwoods.

The Pines can reproduce only by the seed method and are therefore handicapped at first in the struggle to take possession of cut over areas. The Pine has, however, the advantage of being able to start under the shade of the Birches and Poplars; to gradually struggle through, and, owing to the short life of the Birches and Poplars, to eventually overcome them.

There are few of our White and Red Pine areas which would not become restocked if it were possible to prevent fires from sweeping over them. Many of the regions which were cut over in the earlier days of lumbering have produced splendid second growth White and Red Pines. In these earlier operations only the choice

Fig. XIII. Showing one, two, three and four-year-old White Pine plants. Three and four-year-old plants are transplants.

trees were taken and a large percentage of seed trees were left. These areas testify to the ability of the Pines to hold their own in the struggle, if given a reasonable chance.

I wish to point out, however, that with the present methods of cutting, where everything in the shape of pine is taken out, it is not likely that we will obtain satisfactory new growth. Natural reforestation cannot bring back Pine upon regions in which no seed trees have been left. If Pine is desired upon these areas we shall eventually have to depend upon artificial methods or forest planting.

Respectfully submitted,

Minister of Lands, Forests and Mines.
Ontario.

E. J. Zavitz,
Forester.

Appendix No. 39.

REPORT ON THE CONSTRUCTION OF ROADS IN NORTHERN ONTARIO.

(Under the Provisions of 2 Geo. V., chap. 2.)

TO THE HONOURABLE, THE PREMIER.

SIR,—I have the honour to submit a General Report of the work done in the construction of roads in Northern and North-western Ontario during the season of 1914, in conformity with the provisions of 2 George V, Chapter 2.

The season's work commenced about the 1st May, except in a few instances where it was found profitable during the winter season to crush and haul rock material and gravel, construct bridges, and take out timber.

The season was the most favourable we have had for road construction since it began in 1912; during the months of July, August and September, the weather was dry, and good progress was made on the work.

The operations extended from the Petawawa Military Camp on the Canadian Pacific Railway on the east, to the Lake of the Woods on the west; along the line of the Canadian Northern Railway north of Sudbury; along the Temiskaming and Northern Ontario Railway and its branches, from Haileybury north to the Transcontinental Railway; along the latter railway between the Abitibi River on the east and the town of Hearst on the west; along the Soo branch of the Canadian Pacific Railway from Echo Bay to Blind River; and south along the Grand Trunk Railway from Callander to near Powassan; in the valley of the Rainy River; and also in the mining districts around Porcupine, Kirkland Lake, Larder Lake and the Montreal River.

Labour was more plentiful than in previous years, and there was no difficulty in securing all the men required from among the settlers and residents in the districts. Little or no foreign labour was employed, except in the construction of ditches and taking out rock cuts. During the months of June and July, from 4,500 to 5,000 men were engaged on the work. The work was rushed during the early part of the season, owing to the very favourable weather, and in order to allow the roads to dry out before the rainy season began. The work, however, continued during the entire season. At present there are about 225 men engaged in the construction of roads and bridges where it is found at all profitable to carry on work.

During the season up to the 31st October, the sum of $802,578.19 was expended on roads and on experimental farm plots in different places along the Transcontinental Railway. 708 miles of road was under construction, of which 255 miles is new road cut out of the forest. 296 miles of road was graded; 108 miles was surfaced with gravel or crushed rock; 214 miles was partly graded or improved by cutting down hills, ditching, and in other ways improving the grades; 40 bridges were constructed, the longest at Matheson across the Black River, having a length of 650 feet, and a steel bridge at Kakabeka Falls, west of Fort William, 300 feet.

In addition to the construction of roads and bridges, three experimental farm plots were started along the Transcontinental Railway; one near the town of Cochrane, one 50 miles west at the Groundhog River, and one at the town

of Hearst, 130 miles west of Cochrane. The land on which the experiments were made was chopped and cleared in the early part of May, and planted at different intervals between the 15th May and the 1st July. In the growth of grain, roots and vegetables, good results were met with, as in nearly every instance they matured. Spring wheat, oats, barley, rye and peas were not damaged by the summer frosts and were of good quality, and compared favourably with similar crops in Older Ontario. Potatoes, cabbage, onions, carrots, radishes, etc., did exceptionally well and produced large yields, maturing early in the season. Beans, corn, tomatoes and a few other vegetables were more or less injured by the summer frosts, but not more so than in parts of Old Ontario. Where the land was well cultivated and drained and fairly large clearings made, the settlers throughout the district did not suffer materially from summer frosts.

Judging from the crops we produced with a reasonable amount of cultivation, I am confident that there will be no great difficulty in growing almost all classes of grain and vegetables in Northern Ontario. Timothy, clover and alfalfa grow in great abundance almost everywhere along the line of railway both on the low and high lands, and did not suffer from the summer frosts; and good pasture was abundant up to the end of the first week in October.

During the months of July and August the weather was extremely dry and hot, but notwithstanding this fact, the growth of the crops was not much retarded where the land had been properly cultivated.

When inspecting the different districts along the roads which have been constructed during the last three years, I find that good progress is being made by the settlers; along these roads, nearly all the vacant land suitable for settlement is being taken up and improved. In the valley of the Rainy River exceptional progress has taken place; the settlers are now able to reach markets along the Canadian Northern Railway, which three years ago were inaccessible. Heretofore where no roads were constructed, the settler was merely marking time; since the construction of roads, he has taken courage, and is now clearing up large areas of land, and in other ways improving his social condition. This will apply to almost all the sections where good roads have been constructed. It has encouraged the settlers to build schools, and has made it possible for the children to attend them. This in itself has done much to stimulate settlement, as in the past the want of schools and their inaccessibility for lack of roads, I have found to be one of the great obstacles in the way of settlement.

Along the Sault Ste. Marie and Sudbury trunk road; along the trunk roads extending in different directions out of Port Arthur and Fort William; between North Bay and Mattawa; from Sudbury into the agricultural sections to the north and east, the roads are now in such a condition that the settler can reach a market at all times of the year; it has given to his products an increased value, and has removed much of the monotony heretofore found in the life in the new districts. On most of the main trunk roads it is now possible to travel over them in an automobile, and what is probably of greater importance, it has made it possible for a farmer at a distance of from 15 to 20 miles to market his produce, and return the same day.

Splendid progress has been made in the country north of Haileybury along the line of the Temiskaming and Northern Ontario Railway and its branches, in the way of clearing up land.

Along the Transcontinental Railway settlement has not taken place as rapidly as might have been expected, but a good deal of this is owing to the

fact that up to the present time the regular trains have not been run, as the road has been in the hands of the contractors.

Last season was extremely favourable for the clearing up of land, owing to the dry weather, and the settlers in many instances have taken advantage of this, so that during the past season more land has been made ready for cultivation than during the two previous seasons. This applies to the country along the line of the Temiskaming and Northern Ontario Railway as well as along the Transcontinental Railway. If next spring is at all favourable, a much larger area of land will be put under cultivation, provided that the settlers are in a position to procure the necessary seed grain.

During the three years in which operations have been carried on under this Branch, 1,704 miles of road has been under construction, of which 744 miles is entirely new road cut out of the forest; 960 is old road improved; 914 miles was graded and ditched, 180 of which was also surfaced with gravel or crushed rock, and the balance improved by cutting down grades, renewing culverts and bridges, and ditched.

In the descriptions of the several roads hereinafter given, information will be found respecting the operations in the various districts.

Accompanying this report is a statement of expenditure in the different districts, and the number of miles of road constructed or under construction.

I have the honour to be, Sir,

Your obedient servant,

J. F. Whitson,
Commissioner.

STATEMENT OF EXPENDITURE UNDER 2 GEO. V., CHAP. 2, ON ROAD CONSTRUCTION, ETC., AND MILEAGE CONSTRUCTED.

(From 23rd May, 1912, to 31st October, 1914.)

——	1912 miles.	1913 miles.	1914 miles.	Total miles.
New and old roads graded	39	500	405	944
New and old roads partly graded	....	40	214	254
New bush roads cut out ready for grading, and old roads improved	194	224	89	507
Total mileage under construction	233	764	708	1,705

No. of bridges constructed in 1914, 40.

District.	Expenditure to 31st October, 1913.	Expenditure year ending 31st October, 1914.
	$ c.	$ c.
District of Nipissing, North Bay to Mattawa and east to Pembroke, and south of Callander to Powassan, and west from North Bay to Sturgeon Falls	83,313 38	79,086 92
District of Temiskaming, Haileybury, Englehart, Matheson, Charlton, Swastika, Elk Lake, Larder Lake	185,612 61	144,766 69
District of Temiskaming, Cochrane, Porcupine, Iroquois Falls and Transcontinental Railway from Quebec boundary west 125 miles to Groundhog	413,228 30	127,997 62
District of Sudbury, vicinity of the Town of Sudbury and Mining District surrounding	118,568 32	49,526 42
District of Algoma, vicinity of Hearst along Transcontinental and Algoma Central Railways	22,396 32	34,236 29
District of Algoma, on Sudbury and Sault Ste. Marie Trunk Road	76,275 40	80,720 07
District of Thunder Bay, tributary to Port Arthur and Fort William	123,247 31	140,296 30
District of Kenora, vicinity of Kenora and Keewatin.	95,533 58	27,263 85
District of Rainy River, in Rainy River Valley	135,031 31	94,991 78
Experimental Farm Plots	....	9,035 11
General Administration Expenses	21,048 55	14,657 14
	1,274,255 08	802,578 19

ARTHUR E. D. BRUCE,
Secretary and Accountant.

SUMMARY OF EXPENDITURE FOR THE THREE YEARS ENDING 31ST OCTOBER, 1914.

Description.	Year ending 31st Oct., 1912.	Year ending 31st Oct., 1913.	Year ending 31st Oct., 1914.	Total expenditure under each section.
Sec. 1 (a) Works and Improvements (Sewer at Hearst)...	....	....	$2,100 00	$2,100 00
Sec. 1 (b) Roads..............	$193,082 80	$1,081,172 28	791,443 08	2,065,698 16
Sec. 1 (d) Farms..............	....	....	9,035 11	9,035 11
Total expenditure under all sections..................	$193,082 80	$1,081,172 28	$802,578 19	$2,076,833 27

ARTHUR E. D. BRUCE,
Secretary and Accountant.

ROADS IN THE DISTRICT OF KENORA, IN THE VICINITY OF THE TOWNS OF KENORA AND KEEWATIN.

Number of miles of road graded (of which 9 miles were surfaced)........ 15

Operations on the Kenora and Keewatin roads began early in May.

The approaches to the Keewatin Station were repaired by cutting down and widening the rocky approach. A car load of cinders were spread over the approaches and a new ditch was opened up on the north side of the road.

The old wooden bridge from the Canadian Pacific Railway across the channel to the Village of Keewatin was improved by renewing all the old plank in the deck and repairing the railing.

The two steel bridges across the east and west branches of the Winnipeg River were also repaired. They had not been painted since they were constructed and both had to be scraped and repainted. The bridge over the east branch was given two coats of paint, and a portion of the bridge over the west branch also received two coats. A new deck was placed on the bridge across the east branch, also a new railing and wheel guard. The best tamarac plank, 3 in. x 10 in. and 3 in. x 12 in. all seasoned and surfaced on one side, was used. The old joists were replaced by new ones and a new railing was constructed and painted. All the rods were examined and the bolts tightened. These bridges are now in a condition to last for many years. The bridge over the west branch is 242 feet over all, 21 feet wide and is composed of one single span set on four steel tubes filled with concrete and set on cement foundations. There are two approaches, the one on the west end 185 feet long and on the east 150 feet. The bridge over the east branch is composed of three separate spans, the east one 124 feet long, the centre one 158 feet and the west one 140 feet long. The width is 18 feet 6 inches.

After completing these bridges, operations were commenced on the road constructed last season commencing about one-half a mile east of the Village of Keewatin and running north-west across Darlington Bay of the Lake of the Woods through the Township of Pellatt and in a westerly direction to Pelican Pouch Lake. This road was regraded and surfaced with gravel in places. and continued to a point 18 miles from Kenora. It is now in splendid condition, all the heavy grades being cut down and diversions made around hills which were heretofore impassable for heavy traffic. The distance can now be travelled over from Kenora with an automobile in one hour. This road now opens up all the good agricultural land north-west of Keewatin and Kenora.

ROADS IN RAINY RIVER VALLEY, DISTRICT OF RAINY RIVER.

New roads cut and graded	23.75 miles
New roads cut and partly graded	6.25 miles
Old roads graded (including 29.5 miles surfaced with gravel)....	62.10 miles
Old roads partially graded or improved	1.50 miles
Number of bridges constructed	4

During this season work was carried on over 94 miles of road, the greater portion of which was completed. The grading of the trunk road between Fort Frances and Rainy River was finished and there are now 40 miles of gravelled road between these two places. There still remains about 22 miles of this road

to be gravelled, which, when finished, will be of great benefit to the district. In addition to the grading work, the main road was kept dragged where the traffic was heavy. Besides the work on the trunk road, a number of roads were built running north and south from the trunk road, which were badly required. This work may be described as follows:

Township of Mather:

Between Lots 6 and 7, Concessions 4, 5 and 6, three miles. This was a new road and was cleared and graded and culverts put in.

Between Concessions 3 and 4, Lots 5 to 8, two miles. New road cleared and graded and culverts put in.

New road under construction in the Rainy River Valley.

Between Concessions 5 and 6, Lots 6 and 7, ½ mile. New road cleared and graded. This road was put in to connect the old road with our new road between Lots 6 and 7 and to give a road to the school house.

East of Concession 1 and 2, Lot 1, one mile. This was old road which was graded up with the traction engine.

In the Township of Mather there is some very fine clay land. The high land was all burnt over a few years ago, and the land is easily cleared. The land along the road is well settled and the road will be of great benefit to the township.

Township of Crozier:

North boundary of Sections 13, 14 and 15, three miles. This is on the trunk road and was dressed up with the grader and gravelled.

East boundary of Section 21, one mile. Also part of the trunk road. This road was gravelled.

North boundary of Section 21, one mile. Also part of trunk road. This road was gravelled.

East boundary of Sections 32 and 29, two miles. This road was cleared and graded. It leads direct to the station at Crozier and greatly benefits the settlers north, as formerly they had to go several miles around to drive to the station. This road was continued two miles north into the Township of Miscampbell and is now the leading road for settlers to the north of Crozier. About a mile of this road was gravelled by the Municipality of Crozier after the grading was completed.

Road north of Sections 10 and 11, 2¼ miles. This road was cleared and graded. There is a school house at the north-west corner of Section 11, and before the grading of this road it was very difficult for the children to get to the school. This road passes through good farming land all of which is settled on.

Township of Kingsford.

Road between Lots 8 and 9, Concessions 1 and 2, two miles. This road was cleared and graded.

Road between Concessions 2 and 3, Lots 7 to 10, two miles. This road was cleared and graded.

This four miles of road will assist greatly in bringing this township under cultivation. The land along these roads is all settled on and considerable improvements had been made although previously the settlers did not have a road to town.

Township of Dobie:

Road along north boundary of the Township of Dobie across Lots 1, 5, 6, 7, 8, 9, 10, 11 and 12, 4¾ miles. This road was graded by the steam grader.

Road east of Lot 1, Concessions 1 to 6, three miles. This road was graded by the steam grader. This is one of the leading roads north in the district and should be gravelled next season.

Township of Tait:

Road along east boundary of Sections 1, 12 and 13, 1½ miles. This road was graded by the steam grader and is a continuation of the above road in the Township of Dobie.

Township of Carpenter:

Road along east boundary of Lot 11 across Concessions 1, 2 and 3 and north boundary of Lots 10 and 9, Concession 4, two miles. This road passes through a good farming country and was graded by the steam grader.

Road along the Carpenter and Burriss town line, Concessions 4, 5 and 6, three miles. This road was cut out and graded and gives an outlet to settlers who previously did not have a road. This road passes through good agricultural land and should be continued north and south.

Township of Shenston:

Road along the east boundary of Sections 1, 12, 13, 24, 25 and 36, six miles. This road was graded with the steam grader. This is the leading road north from the Village of Barwick, and runs through a well settled district and there still remains considerable good land to be opened up to the north. This road extends 13 miles north of Barwick and as the traffic is heavy it should be gravelled.

Township of McIrvine:

Road across lots 44 to 48 and west of Lot 48, ¾ mile. This is part of the trunk road. This road was gravelled.

Township of Barwick:

Road commencing on east boundary of River Lot 1, thence westerly along trunk road 2½ miles. This road was gravelled.

River Lot 1, trunk road, built pile bridge span 110 feet.

Township of Rosebery:

Trunk road along the south and west boundary of section 2, one mile. This road was gravelled.

Township of Dance:

Concessions 2, 3 and 4 between Lots 8 and 9, 1¾ miles. This road was cleared and grubbed.

Road across Lots 9 and 10 between Concessions 3 and 4, one mile. This road was cleared and grubbed.

Road between Lots 8 and 9, Concession two, ½ mile. This road was graded and ditched.

Previous to last year there had not been any road work done in the Township of Dance, excepting about ½ mile in Concession 1. There are now 5½ miles of road cut out and grubbed, 2 miles of which have been graded. The road cut out should be graded up next season. The south half of this township is good land and well settled and only requires roads to make it a first class farming country.

Township of Atwood.

Road across River Lots 1 to 24, three miles. This is part of the trunk road. It was graded and ditched and 2 miles of it gravelled. Road between River Lots 23 and 24, one mile. This road was graded.

Wild Lands Reserve.

Road commencing at the north-east corner of Lot 9 in the Township of Curran, thence north-easterly a distance of 4 miles. This road requires to be extended back a distance of 4 miles to give an outlet to the settlers in the Township of Spohn. The first 4 miles have been cleared and graded.

Township of Blue:

Road commencing at the north-east corner of Lot 34, thence east 1½ miles on north boundary of sections 35 and 36. This road was cleared, graded and ditched.

Township of Pratt:

Road across Concession 1, Lots 5 and 6, 1½ miles. This road is part of the Sleeman Grassy River road and was graded and gravelled.

Township of Dilke:

Road along east boundary of Section 24, ½ mile. This road was graded and ditched and 400 feet of tap drain dug.

Road along the south boundary of section 25, one mile. This road was ditched on each side and 914 feet of tap drain dug.

Road along the west boundary of Section 25, ¼ mile. This road was graded.

Road across Section 26, one mile. This road was graded and gravelled.

Road north of Sections 35 and 36, two miles. This road was graded, 3 culverts put in and 6,458 feet of ditching done.

Road across Sections 27 and 28, two miles. Old road was re-graded and gravelled.

Road between River Lots 24 and 25, ¼ mile. This road was gravelled.

Township of Morley:

Road along north boundary of Sections 20 and 21, 1½ miles. This road was double ditched and crosslay put down.

Road commencing at the north-east corner of Section 10, thence easterly 2 miles. This road was gravelled.

Township of Pattullo:

Road along east boundary of Sections 4 to 33, six miles. This was an old road that had been poorly built and was impassable. The 6 miles of road were graded, 2 bridges of 40 and 30 feet span put in, and ditches and tap drains put in to carry the water away. The first 3 miles of this road were gravelled.

Road east of Sections 24 and 25, 1½ miles. This road was cleared and grubbed. This road should be graded next season and continued back to the north boundary of the township. The settlers at present there have to pack their supplies on their backs and there is a good farming district to be opened up.

Township of Worthington:

Road across River Lots 1 to 9, one mile. This road was ditched and graded.

Road across River Lots 25 to 32, one mile. This road was graded.

Road across River Lots 41 to 48, one mile. This road was re-ditched and graded.

Township of Lash:

Road along the north boundary of Sections 25, 26, 27 and 28, four miles. This is part of the trunk road and was gravelled.

East boundary River Lot 41, built pile bridge, span 65 feet, on trunk road.

Township of Devlin:

Trunk road along the east boundary of Section 29, one mile. This road was gravelled.

Trunk road east boundary of Section 22 and north boundary of Sections 23 and 24, 1½ miles. This road was gravelled.

Township of Burriss:

Road across Concessions 1, 2, 3 and 4, between Lots 4 and 5, four miles. This road was graded and ditched and two miles gravelled. This is the leading road north of LaVallee, and previous to the work of this branch, part of the road was impassable in the summer. It is now one of the best roads in the district. This road should be continued north and the remainder gravelled.

Township of Miscampbell:

Road between Lots 8 and 9, Concessions 1 and 2, two miles. This road was graded and culverts put in. This is the main road in the township and was badly in need of grading.

Township of Nelles:

Road between Sections 14 and 15, ¾ mile. This road was grubbed and ditched on one side.

Road between Sections 26 and 27, and 34 and 35, two miles. One mile and 500 feet of this road was double ditched and one mile cleared and grubbed. This road passes across a bad swamp and muskeg, but there is a lot of good land to the north which it will open up if continued.

Also five miles of tap drain were dug and 74 culverts put in.

FORT WILLIAM AND PORT ARTHUR DISTRICT.

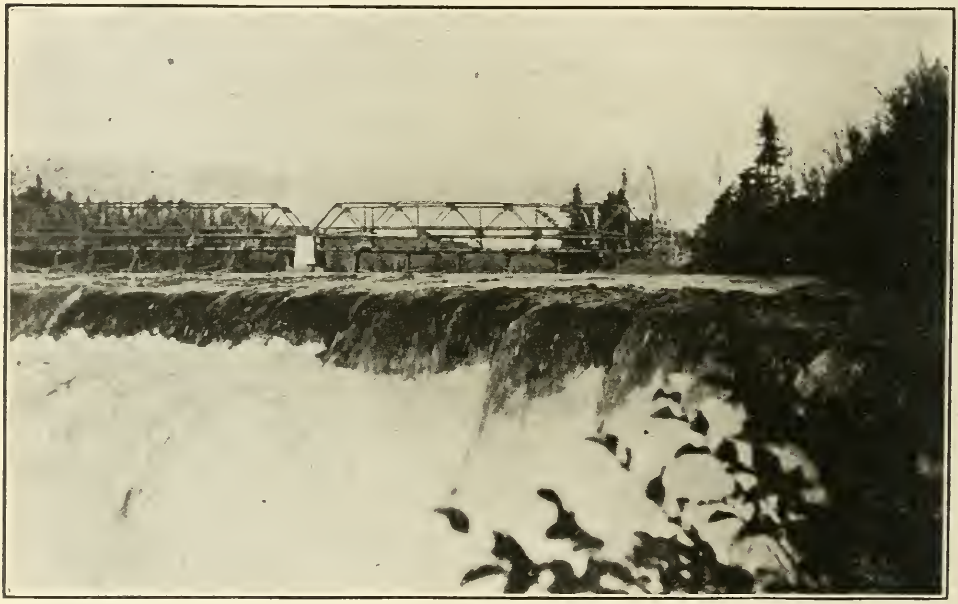
Number of miles new road cut out	60.45
Number of miles graded	32.5
Number of miles resurfaced with gravel	31.25
Number of miles partly graded or improved	76.20
Number of miles under construction	139.95
Number of bridges constructed	9

Pigeon River Road:

Work was begun on this road at the westerly limit of the City of Fort William, where re-ditching, re-grading and surfacing was done for 14 miles. On this stretch the first 3¾ miles were gravelled, two hills having first been cut down and the road grades improved by deepening fills at low lying points. The next 2½ miles (being in an area of poor drainage having little fall for the escape of water) was surfaced with crushed rock. This rock was got at the foot of McKay Mountain, was crushed by a Blake crusher and distributed to a depth of 8 inches along the

Kakabeka Falls on the Kaministiquia River, twenty miles west from Port Arthur.

road. Two low lying spots (in all about ½ mile) were filled with boulder stone and these covered with gravel. The piers and stringers of a 24 foot bridge were renewed and three hills cut down on the remaining part of the above mentioned stretch. This road was then further extended for 11 miles; was cleared, grubbed, graded and ditched, and corrugated iron culverts set in place and three wooden bridges, each 40 feet in length, erected. The road at this point is at the settlement of Cloud Bay. A further stretch, 6 miles in length, was cleared and grubbed; this ends at the Pine River. The remainder of the road was surveyed and the centre line was cut out. The whole length of this road was found to be 37 miles, of which 12 miles remain to be graded. There is a road, with fair grades but narrow roadway, along the Pigeon River; 4 miles of which can be made use of in the extension of this road, leaving 8 miles to be cut out to complete the road to the Pigeon River or International Boundary.



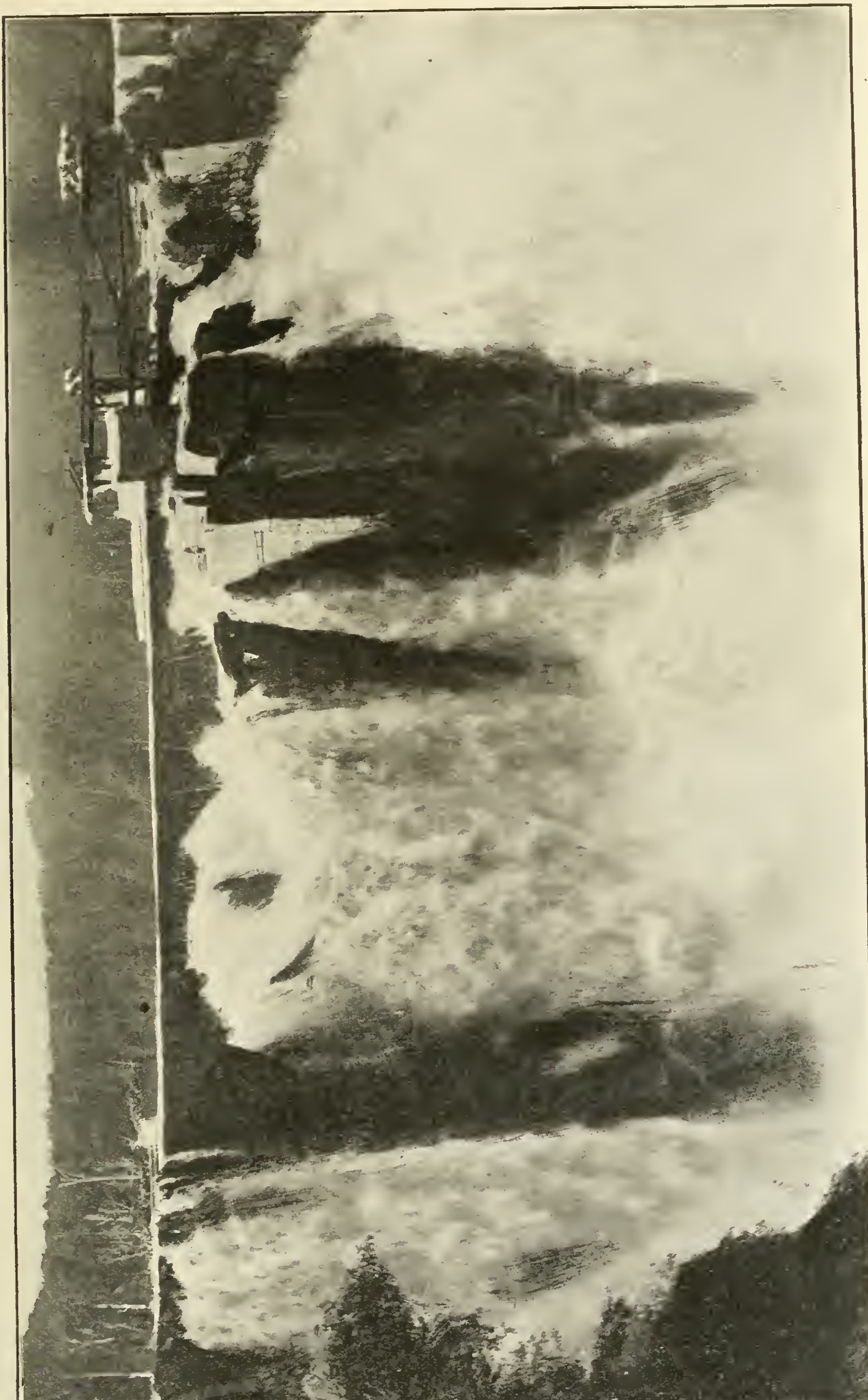
Constructing a steel bridge across the Kaministiquia River at Kakabeka Falls; 30,000 h.p. developed at this point.

Scoble Road:

Hill cutting, re-grading and ditching was done on the first 4½ miles of this road along the town lines of the Townships of Blake and Scoble, and southwesterly in the Township of Scoble, together with about ½ mile of grading on the line between Lots 6 and 7 in the Township of Pearson, and a further distance of about a mile, on this line, was cleared and grubbed.

Arthur Street Road:

The first 4 miles of this road was gravelled; the following mile was not improved (being a good sandy and dry roadway), the next mile and a half was gravelled, a bridge 20 feet long and two cedar culverts were set in place, and a



Pigeon Falls on Pigeon River on the International Boundary, 1½ miles from Lake Superior. A splendid water power; available head, 105 feet.

ditch and offtake, about ½ mile in length, was made. Then 3 miles of this road was re-graded, i.e., as far as the crossing of the Canadian Northern Railway. Five corrugated iron culverts were set in this stretch.

At a point about a mile west of the Canadian Northern Railway, where the road passes through a deep cut of shifting sand, the roadway was covered with clay to the depth of 18 inches for about 600 ft.

A 42 inch corrugated iron culvert was set in place and the fill, which had been of sand but had washed away, was replaced by a battery of logs and clay fill; this was at a point about 2 miles easterly from Stanley.

For about ½ a mile north easterly from Stanley the roadway was filled with boulder stone to a depth of one foot and the whole was covered with gravel.

Re-grading was done from Stanley for 2½ miles; a 36 inch corrugated iron culvert and 4 cedar culverts were set in place and the road was gravelled for 2 miles.

Clearing, grubbing and grading was continued for 2½ miles further to the Silver Mountain Road. Low spots were stone filled and covered with gravel, about ½ mile in all.

Clearing and grubbing was done from the Silver Mountain Road towards Hymers, about one mile in length, this being a diversion from the old road.

Gillies Road:

This is a diversion or cut off the present road. Clearing and grubbing was done for ¾ of a mile on this proposed road. The diversion runs south from Hymers and is intended to overcome a steep grade and to reduce distance.

Hardstone Road:

From Hardstone Station, Port Arthur, Duluth, and Western Railway, to the Silver Mountain Road (or Arthur Street Road) near Stanley. Clearing and grubbing was done for 2¼ miles on this road. This road is the outlet for the Whitefish Valley settlements.

Oliver Road and Extensions. (20½ miles; of this 3½ is new work.)

These roads were ditched, re-graded (including eight hills cut down to improve grades) and surfaced with gravel, shale or best material available (about 5 miles of gravel or shale). Four corrugated iron culverts and 5 cedar culverts were set in place. A steel bridge 300 feet overall, on concrete piers and abutments, was erected at the crossing of the Kaministiquia River, above the crest of Kakabeka Falls. This bridge consists of two spans of 90 feet each and has a concrete floor. The approach to the west of these spans consists of 4 spans of about 30 feet each. They also are of steel and have a wooden floor.

The new work on these roads consisted of 3½ miles of road building, and 4 cedar culverts placed.

John Street Road:

This road was re-graded for 7½ miles from the westerly limits of the City of Port Arthur. Three miles of this was surfaced with gravel.

Dawson Road:

This road was re-graded for 10 miles from the westerly limit of the City of Port Arthur, was thoroughly ditched and all culverts renewed, one 15 inch iron culvert was set in place and the piers and stringers of a 25 ft. bridge were renewed.

North East Branch Road:

North-easterly from the City of Port Arthur in the Township of McGregor. This road was graded for 6 miles and a further distance of 4½ miles was cleared and grubbed.

Gorham Town Line Road:

Road between the Townships of Gorham and McGregor. This road was graded for ½ mile and a further distance of 4½ miles was cleared and grubbed. A bridge 70 ft. overall was raised 10 ft. and the stringers were renewed.

Gorham Road:

Beginning at the north-west angle of the limit of the City of Port Arthur; thence north from the Dawson Road. This road was graded for 5 miles and a further distance of 4½ miles was cut out and grubbed.

Dog Lake Road:

Beginning at the Dawson Road at the intersection of the "6 mile creek" thence north. This road and its feeder was graded for 5 miles; the whole was gravelled and a bridge (50 ft. long) was renewed.

8 Mile Road:

Beginning at the Dawson Road and following the line between Lots 28 and 29. This road was graded for ½ a mile and a further distance of 3 2-5 miles was cut out and grubbed.

Mud Lake Road:

Beginning at the Dawson Road and following the line between Lots 10 and 11, Ware. This road was graded for about one mile and a further distance of 4⅓ miles was cut out and grubbed.

Concessions 1 and 2, Ware:

This road was cut out and grubbed for a distance of 3 miles.

Concessions 2 and 3, Ware:

This road was cut out and grubbed for a distance of 4½ miles.

Kaministiquia Road:

Beginning at the Dawson Road and following the easterly bank of the river. This road was cut out and grubbed for 4 miles.

Total clearing in the Townships of Ware, Gorham and McGregor, 32.63 miles.

The McLaughlin or 3rd Line:

A little over a half a mile of this road, near the Dorion station, where the same ran through a bad swamp area, was deeply ditched and gravelled.

Road North Westerly from Ouimette Station:

This road was ditched, graded, and the hills on the Coldwater River cut down, and for two miles the road was well gravelled.

Road Easterly from Ouimette Station to Settlement at Dorion:

Improved for 3½ miles. This road was ditched, graded and 9 cedar culverts were put in. In all low lying spots the roadway was raised and then well covered with gravel, about one mile of such gravelling was done on this road.

THE SAULT STE. MARIE AND SUDBURY TRUNK ROAD; AND ST. JOSEPH ISLAND ROAD VIA CAMPEMENT D'OURS ISLAND.

New roads cut and graded	10.25 miles
Old roads graded (including 10.75 miles surfaced).......	14.25 miles

Sault Ste. Marie and Sudbury Trunk Road:

One mile of this road was surfaced immediately east of the Root River, between miles 5½ and 6½ east of Sault Ste. Marie. The material used was trap rock with a top course of limestone.

Two miles of trap in the single course were laid on heavy sand at Little St. Joseph Island, being on the 13th and 14th miles east of the Sault. This camp also made miscellaneous repairs on the section between the Sault and Echo Bay. It completed the embankments at Garden River Bridge built by the Public Works Department and erected railing on it and surfaced it with 200 yards of trap with a top course of limestone.

This camp was moved to Day Mills about the middle of July and commenced construction of section between that point and Iron Bridge. When the work

closed down for the season one and one-half miles had been cleared and brushed and graded and a quarter of a mile of gravel put down. Many of the old log culverts were removed and the new corrugated metal ones were not installed, this for the reason that the shipment of culverts did not arrive until the work had stopped. These culverts are stored at Dayton Station.

Culverts of corrugated metal were placed between Desbarats and McLennan and equipped with concrete ends. One-half mile of this section which was in bad condition was regraded and gravelled. The remainder of the section is in very good state of repair and it was decided not to do anything with it for the present. Three miles of road immediately west of McLennan's, being mile 24, 25 and 26 east of the Sault, were rebuilt, graded and gravelled. Several bad grades were cut down. Metal culverts were installed throughout, all with concrete ends.

A 40 ft. steel bridge on piled concrete abutments and with concrete floor was erected across the Shewfelt Creek. The embankments were equalized making an easy approach at each end.

At Bruce Mines a reinforced concrete culvert 6 x 8 was built two miles east of Bruce Mines. Three-quarters of a mile of road was graded and one-third of this surfaced with trap rock, 10 ft. wide and with gravel shoulders. This work is not yet finished. Culverts are on the ground ready for installation.

In this section a new route for the Trunk Road was arranged through the Town by agreement with the Council. The original survey ran north of the Town and involved construction of one and one-half miles of new road over boulder imbedded ground. The revised location goes through the centre of the town and requires construction of only half a mile of new road and this of an easy nature.

A road was cleared, built and graded across Campement d'Ours Island, intended, in conjunction with the ferry to be established, to furnish the settlers on St. Joseph Island an access to the mainland at Kensington Point and then with the Trunk Road at Desbarats, by means of road one and a half miles in length, on which work was done during the present season and which is subsequently referred to. This road, one and three-quarter miles in length, ran for its entire length through very heavy bush and over ground covered in part with boulders. On its completion at the end of June, operations were commenced on the building of a road on a new location between Thessalon and Nesterville. The new location is three and a half miles in length as against five miles for the old road and will be when finished, of a much superior nature, its bed being composed of sand and gravel as against clay for the old road. Two and a half miles of this section was cleared and grubbed, the balance being already open. One and one half miles have been graded and one mile gravelled; the rest being left uncompleted. In addition two miles of road immediately west of Nesterville, built during the season of 1913, was gravelled.

Four and a half miles of road was built and graded along the Mississaga River from a point eight (8) miles west of Blind River to a point twelve and a half (12½) miles west. On this section metal culverts were installed, all with concrete ends. The balance of the culverts to complete the road to Iron Bridge are on the ground. This camp also placed concrete ends on twelve (12) culverts installed during 1913, on the portion of road to the east. The road leading from Desbarats to Kensington Point, 1½ miles in length, was improved, by clearing along the sides, regrading and gravelling. Half a mile of gravel was laid and three-eighths of a mile through swamp was raised by filling in. Numerous boulders were removed from the southerly half mile of the road.

During the winter, early in 1914, three (3) miles south of Echo Bay were gravelled by contract. Also an outlet ditch one mile east of the Sault and one-half mile in length, was constructed to the River St. Mary, under contract. This was done to carry off to sufficient outlet, water from the Trunk Road which had been flowing across and damaging an adjacent farm.

The total amount of road covered with this season's work was 24½ miles of which three miles were surfaced with stone and 7¼ gravelled. On all the road completed permanent metal culverts were installed with concrete ends. In addition one forty (40) foot steel bridge and a 6 x 8 reinforced concrete culvert were built. Culverts are on the ground to finish the whole division between Sault Ste. Marie and Blind River, with the exception of that part between Thessalon and Day Mills.

On the trunk road between Sudbury and the Murray Mine.

ROADS IN THE SUDBURY DISTRICT.

In the Blezard Valley and north along the Canadian Northern Railway to Capreol Junction, and north-east from the Garson Mine to Wahnapitae Lake.

Number of miles graded (of which 6 miles were cut out)	28 miles
Number of miles resurfaced with stone and gravel	6 miles
Number of bridges constructed	5

Work was begun along the Canadian Northern Railway at Capreol Junction 20 miles north of Sudbury early in May. A trunk road was cut out southerly along the railway to Hanmer Station, 5 miles, to the line between Concessions 2 and 3, Township of Capreol. The first 3 miles of this road passed through a country chiefly gravel and sand, and the next 2 miles through a fairly good level agricultural country. From Hanmer Station the road was continued west along the line between Concessions 2 and 3, one mile, to the Village of Hanmer on the town line between the townships of Capreol and Hanmer; thence west between Concessions 2 and 3, Township of Hanmer for 4 miles across lots 1 to 8 inclusive. The work consisted in cutting out and widening a partly constructed old road. The road was well ditched and graded and all old culverts renewed. The country is level, well settled and under cultivation; the soil a light sandy loam.

The old road between Lots 6 and 7, Hanmer, was widened, ditched and well graded across Concessions 1, 2, 3, 4, 5 and part of 6, to the Vermilion River, 5½ miles.

A new truss bridge, 34 foot span, was constructed across Whitson Creek on Concession 6, Township of Blezard.

The trunk road graded and ditched last season from Sudbury north into the Blezard Valley was re-surfaced with crushed rock from the Stobie Mine road, where rock surfacing ended last season, north to the line between Concessions 5 and 6, Blezard, between Lots 6 and 7 for a distance of 6½ miles. Waste rock from the mines and from a mountain on Lot 7, Concession 4, Blezard, was crushed and 800 cubic yards per mile was spread on the road to a width of 9 feet, and well rolled with a ten ton steam roller. Several culverts or small bridges were

Tyadala Bridge, near the Spanish River, on the Soo branch of the C.P.R.; 140 ft. long.

renewed by large corrugated iron culverts. There is now a first-class stone road leading north from the Town of Sudbury into the agricultural valley of the Blezard, and a good clay and gravel road as far as Capreol Junction on the Canadian Northern Railway over 20 miles from Sudbury, which distance can easily be covered by automobile in less than one hour.

The town line between Capreol and Hanmer Townships, across Concession 2, one mile, was stumped and graded.

A road between the Townships of Hanmer and Blezard across Lots 1 and 2, one mile, and between Lots 2 and 3 across Concession 6, Blezard, one mile, was cut out and graded, and a bridge, 40 foot span, constructed across Whitson Creek on road between Lots 2 and 3. These roads will enable the settlers to reach the Canadian Northern Railway station at Bertrands or Hanmer.

A road between Lots 10 and 11, Concession 6, Hanmer, one mile was graded; also a road between Lots 2 and 3, Concession 6, Township of Lumsden, one mile.

and the trunk road between Concessions 5 and 6, Township of Rayside, across Lots 1 and 2, one mile.

The old bridge, which had become unsafe for traffic, on Lot 9, between Concessions 5 and 6, Blezard, was replaced by a new pile bridge, 36 foot span, with truss.

From the Garson Mine to Wahnapitae Lake, a distance of 10 miles, the old timber road was widened, straightened and graded to enable a small settlement on Massey Bay, Township of Maclennan, to reach a market at Sudbury. This road also makes it possible to reach the nickel range west of Wahnapitae Lake from Sudbury.

The old wooden bridge across Whitson Creek on Lot 4, between Concessions 2 and 3, Township of Balfour, 1½ miles south-west of Chelmsford, on the trunk road west of Chelmsford, which was unsafe for traffic, was renewed by a pile bridge 66 feet long with a 36 foot truss.

A new pile bridge with steel stringers 140 feet in length was constructed across the Tyadala River on the Sudbury and Sault Ste. Marie trunk road close to the Spanish River in the Township of Nairn, 3½ miles east of Nairn Station on the Algoma Eastern Railway. The old bridge had partly fallen down and was unsafe for traffic.

ROADS IN THE VICINITY OF AND TRIBUTARY TO NORTH BAY

New roads cut out (of which 3½ miles were graded)	26 miles
Old roads graded	9½ miles
Old roads partly graded or improved	25 miles
Old roads surfaced with gravel or stone	20 miles

North Bay to Sturgeon Falls Trunk Road.

Operations on this road were commenced about the middle of June. The road extends from the western limit of the Town of North Bay westerly along the northern limit of the right-of-way of the Canadian Pacific Railway for a distance of about 1½ miles to the Duchesney Creek. From this point the road continues north-westerly crossing to the north side of the Canadian Northern Railway; thence along the north limit of the Canadian Northern Railway to a point about one-quarter of a mile from Beaucage Station. It then crosses the Canadian Northern Railway to the north limit of the Canadian Pacific Railway, and from this point it continues westerly adjacent to the north limit of the Canadian Pacific Railway until it reaches the west limit of the Indian Reserve. At this point it crosses to the south side of the Canadian Pacific Railway and follows the colonization road to the Town of Sturgeon Falls.

A careful exploration survey was made of the ground before the road was located. Several deviations around high rocks had to be made east of Beaucage. From Beaucage west to Sturgeon Falls the road passes through a very level country with scarcely a grade. Around the mountains good grades were found so that the road when completed will have few grades to interfere with heavy traffic. It passes through a country in places heavily timbered with birch, hemlock and other timbers. The finest timber, however, has been nearly all cut out. The road was cut to a width of 66 feet and in places it has been grubbed and is now ready for grading. In other places it has not been stumped.

The work has been continued since the close of the season and at the present time gravel is being drawn, and timber taken out for culverts and bridges. Abundance of good cedar for the construction of culverts is available along the road. Two car loads of corrugated iron culverts have been shipped on the road ready for use as soon as grading is resumed. The road has been well graded and good stone or concrete culverts constructed as far as Duchesney Creek. West of Duchesney Creek for about one mile the road has been well graded, although it will require to be surfaced with gravel in places where the soil is light and sandy.

Heretofore there has been no means of communication by road between North Bay and Sturgeon Falls, the distance being about 22 miles. When this road is completed the farmers in the vicinity of Sturgeon Falls and the small villages west, will be able to market their produce in North Bay. The road will also open up a large area of good agricultural land in the western part of the Reserve. The eastern part of the Reserve along the road is broken and rocky in places.

North Bay and Mattawa Trunk Road.

The trunk road between North Bay and Mattawa, the length of which is 50 miles, was constructed and graded during the season of 1913. As there was a great deal of traffic on this road it was badly cut up during the wet seasons, spring and fall, and it was found necessary to re-grade and surface with stone and gravel a large portion of this road.

A stone crusher was set up near Callander early in January, 1914, and was continued at work throughout the entire winter up to about the latter part of May. Crushed stone was hauled on to the road between Callander and North Bay for a distance of about 6½ miles. Six thousand cubic yards of crushed rock was spread on the road for a width of 12 feet between North Bay and Callander. It was well rolled with a ten ton roller.

Between Callander and Mattawa 13 miles of old road was re-surfaced with coarse gravel. Through the village of Bonfield, where the road was very narrow, it was widened by removing the large boulders from the side and well surfaced with gravel. The road between Callander and Mattawa is now in first-class condition. Most of the old culverts were replaced by cedar or corrugated iron ones. The ditches in many instances had to be deepened.

The old wooden bridge across the Amable du Ford River, in the Township of Calvin, was replaced by a substantial bridge, built on concrete piers and abutments, with steel girders; the length of this bridge is 130 feet.

The road is now in first-class condition and the distance, 50 miles, can be made with an automobile in about three hours.

Callander to Powassan Road.

From Callander south to Powassan, a distance of about 12 miles, there was an old road with bad grades, badly drained in places and impassable for heavy traffic. This road was widened out, ditched, graded and surfaced with gravel in places, for a distance of 9 miles. The road passes through a country in which there is considerable good agricultural land but broken in places by rocky ridges. The settlers have heretofore, had a good deal of difficulty in reaching a market for their produce, either at North Bay, Powassan or Callander. During the spring and fall of the year the road was always in a bad condition. It was necessary to cut down many of the hills in order to improve the grade. Good substantial cedar

or corrugated iron culverts were placed where required. The road was straightened out in many places.

The wooden bridge about three-quarters of a mile south of Callander, which had become unsafe for traffic, was replaced by a large stone culvert 8 feet wide, 6 feet high and 40 feet long.

Chisholm Township.

A branch road was constructed leading from the main trunk road into the Township of Chisholm: 3½ miles was cut out and widened, 2 miles of which was graded. This road was constructed for the purpose of giving to the settlers in Chisholm a good out-let to a market at Callander or North Bay. Part of the road is through a broken section. The road, however, opens up one of the best agricultural sections in the District of Nipissing. There is still about 2½ or 3 miles of this road to be completed.

PEMBROKE AND MATTAWA ROAD.

(From Pembroke to the Petawawa Military Camp.)

Number of miles of new road graded	2.0
Number of miles of old road graded	9.3

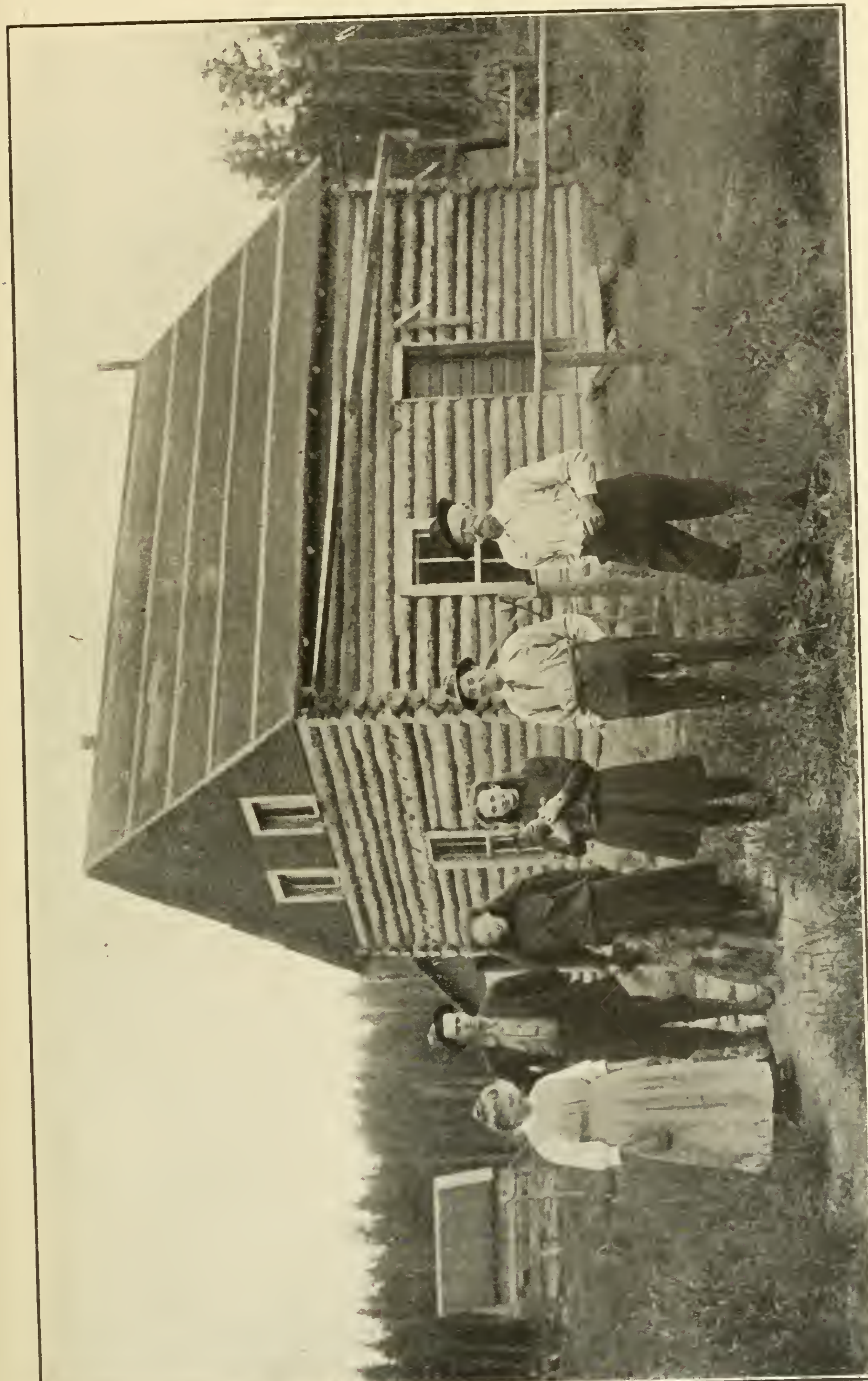
Operations were carried on commencing at the westerly limit of the Town of Pembroke, passing through the Townships of Pembroke, Stafford and Alice to the southern boundary of the Township of Petawawa, a distance of three miles, the remainder being through the Township of Petawawa to the Village of Petawawa on the main line of the Canadian Pacific Railway, a total distance of 8.3 miles.

For the first three miles we re-graded the old travelled road, it being necessary only to widen a few embankments and raise the grade line in a few places. The soil generally is light and sandy.

Through the Township of Petawawa we followed the old travelled road with the exception of two diversions, where by keeping adjacent to the north side of the Canadian Pacific Railway we avoided two level railway crossings in each case, and shortened the distance in all by about 200 feet. About two miles of this was through bush land, through which we cleared a right-of-way forty feet in width, removing stumps, etc., for a width of thirty feet. The first three miles is light sandy soil, making a very dusty road in summer. The remainder is fine gravel, not coarse enough for road metal but will afford a good foundation for a permanent road. The grading was performed by using scrapers and road grader, and when completed will be practically free from grades, as it runs through a fairly level plain, crossing only one short ravine.

The only road metal available will be crushed stone, and there is only one out-crop of rock along the road situated about one mile west of the Town of Pembroke.

On this road there is a considerable amount of traffic in summer months by automobiles, it being used by motorists and others going from Pembroke to the Petawawa Military Camps, and to the mouth of the Petawawa River, where a number of Pembroke citizens have summer cottages. The automobiles cut up the grading on the sandy portion of this road very badly, and it will be advisable to re-surface this road with either coarse gravel or crushed rock.



A Settler's House, Krugerdorf, Township of Catherine, T. & N. O. Railway.

HAILEYBURY AND SOUTH LORRAIN ROAD.

New road cut out .... 10 miles.
(Of which 7 miles was graded.)

Work was commenced on this road early in May, 1914, commencing at Argentite Ave. in North Cobalt on the line between Concessions 1 and 2, Township of Bucke, Lot 13, and continued in a south-easterly direction across the 1st Concession of the Township of Bucke, entering the Township of Lorrain on Lot 3, Concession 12, and continued in the same direction through the said township to a point in front of Paradise Bay on Lake Temiskaming, a distance of 10 miles.

The road was cut out, logged and graded for a distance of 7 miles; two bridges were constructed and several culverts built. The road in places was surfaced with gravel, and throughout its entire length was well ditched. Previous to starting operations, a survey was made from South Cobalt to the mining districts in South Lorrain. The road passes through a country which is broken in many places with rocky ridges; in the valleys however there is first-class farming land found in small areas.

ROADS IN THE VICINITY OF ENGLEHART AND CHARLTON.

Number of miles of new roads cut out, of which 3.5 were graded and 1 partly graded	9.5
Number of miles of old roads graded	5.5
Number of miles of old roads regraded or otherwise improved........	45.0

Townships of Pacaud and Catharine:

Road along Pacaud-Catharine boundary across Concessions 1 and 2, two miles, partially graded; and one mile across Concession 3 cut and stumped.

Road on Chamberlain-Pacaud boundary, across Lots 3 and 4, one mile graded; and 1½ miles across Lots 5, 6 and 7 regraded and hills cut down.

Township of Chamberlain:

Road between Concessions 5 and 6, across Lots 3, 4, 5 and 6, two miles partly graded, and one mile of same cut and stumped.

Road between Lots 2 and 3, north from south boundary, widened and regraded four miles. The northerly two mile portion partially graded, and three large permanent fills made to replace bridges.

Road between Lots 9 and 10, across Concessions 1 and 2, graded two miles, and right of way widened from 30 feet to 66 feet.

Road between Concessions 1 and 2, across Lot 1. graded ½ mile.

Township of Marter.

Road between Concessions 3 and 4, across Lots 9 and 10, graded three-quarters mile.

Road on south boundary, across Lots 7, 8, 9 and 10 regraded two miles.

Crop of Oats in the Township of Marter.

Township of Evanturel.

Road between Concessions 5 and 6, across Lots 6, 7, 8 and 9, cut and stumped, two miles, and half-mile across Lot 6 graded; also half-mile across Lot 10 graded.

A bridge across Blanche River was partly constructed; the piles and the westerly approach were completed.

Road between Lots 10 and 11, across Concession 6 and part of Concession 5, 1½ miles, and 6½ miles of trunk road between Englehart and Heaslip regraded, and 2 miles graded.

Road between Concessions 1 and 2, across Lots 2, 3 and 4, stumped and partially graded, 1½ miles.

Road between Lots 10 and 11, Concession 5, hills cut down and graded for southerly half-mile.

Road between Lots 11 and 12, Concession 5, stumped and graded one mile, and between Concessions 4 and 5, across Lot 12, stumped and graded ½ mile.

Township of Armstrong.

Road between Lots 5 and 6, across Concessions 4, 5 and 6, regraded three miles.

Road between Concessions 3 and 4, across Lot 6, regraded half-mile.

Road between Concessions 5 and 6, across Lots 4 and 5, stumped one mile, half a mile of which was graded.

Road on north boundary, across Lots 2, 3 and 4, stumped 1½ miles, and across Lots 7 and 8 cut and stumped one mile.

Township of Dack.

Eight miles on the Charlton-Englehart road widened, ditched, regraded and grades improved by cutting down hills; also culverts renewed.

Road between Lots 9 and 10, across Concession 6, widened and graded 1½ miles; also between Concession 5 and 6, across Lot 9.

Road between Lots 2 and 3, across Concession 6, regraded one mile.

Road between Concessions 4 and 5, across Lots 11 and 12, regraded one mile, and one 35-foot bridge constructed.

Township of Savard.

Road on south boundary across Lots 1 to 6, three miles widened and graded, and one 30-foot bridge constructed on Lot 5.

Road between Lots 6 and 7, across Concessions 1 and 2, two miles graded, and one 30-foot bridge constructed.

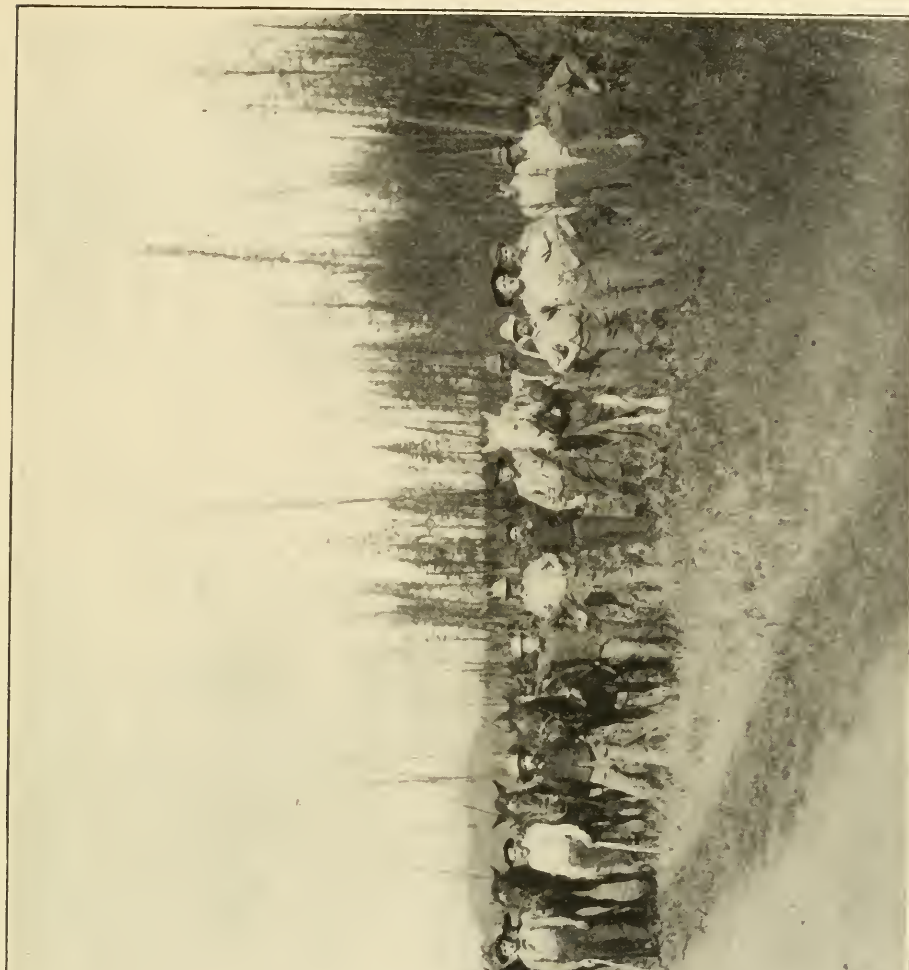
Road between Concessions 2 and 3, one mile new road partially graded and right of way widened; also two miles between Lots 8 and 9, across Concessions 3 and 4.

Township of Robillard.

Road between Concessions 4 and 5, across Lots 1 to 10, five miles: 1½ miles along Long Lake in Concession 5, and 1 mile of west boundary across Concession 6 widened and regraded, and cut down hills.

Township of Sharpe.

Road on east boundary, across Concessions 1 and 2, cut and stumped two miles.



Logging and Stumping Bee, Township of Evanturel.

Bridge across the Black River at Matheson, 650 feet long; T. & N. O. Ry.

ROADS IN THE DISTRICT OF TEMISKAMING IN THE VICINITY OF MATHESON AND LARDER LAKE.

New roads cut out but not graded	6.50	miles
New roads cut and graded	9.25	"
New roads partly graded	12.5	"
Old roads graded	26.5	"
Old roads improved	26.00	"
Number of bridges constructed	3	

Log jams and driftwood were cleared out of the Wahtaybeg River from Lot 9, Concession 3, to Lot 11, Concession 1, Township of Carr, to allow the settlers to drive pulpwood and logs to the pulp mills at Iroquois Falls and local saw-mills along the river.

Road on line between Lots 2 and 3, Concessions 1 and 2, Twp. of Carr, two miles, cut and graded.

First Street, Town of Matheson, ¼ mile graded and one 36-inch corrugated culvert pipe placed.

Another view of Bridge at Matheson, T. & N. O. Ry.; 650 feet long.

Road on town line between Carr and Bowman, and Currie and Taylor; eight miles of road widened from 20 ft. to 30 ft. and culverts repaired.

On trunk road south from Matheson, along Temiskaming and Northern Ontario Railway, in the Twps. of Bowman, Hislop, and Playfair, grubbed two miles, graded six miles, and improved eight miles of old road.

Mining road from Larder Lake road to Huronia Mine, through the Twp. of Gauthier; six miles chopped, stumped and grubbed, two miles of which was graded.

Road between Concessions 3 and 4, Twp. of Carr, across Lots 1 to 4; two miles chopped, stumped and grubbed, and culverts put in from line between Lots 4 and 5 to town line, and 1½ miles chopped, stumped and grubbed between Lots 4 and 5, from Concession 5 to Concession 6.

Road on town line between Stock and Bond; chopped and graded 2¾ miles across Lots 1, 2, 3, 4, 5 and part of 6.

Road between Concessions 2 and 3, across Lots 1 to 7, Twp. of Taylor, 3½ miles graded.

Harvesting Fall Wheat at the Ontario Government Experimental Farm, Monteith, T. & N. O. Ry.; yield, 35 bushels per acre.

Road between Concessions 2 and 3, Twp. of Carr; ¾ miles graded, and on town line between Carr and Beatty, 2 miles graded from Concession 4 to Concession 6.

Road between Concessions 5 and 6, across Lots 2 to 7, Twp. of Taylor, three miles graded.

On road between Concessions 5 and 6, Twp. of Hislop; pile bridge, 25 foot span constructed.

Road between Currie and Bowman; three miles grubbed and graded across Concessions 1 to 3.

Road between Hislop and Bowman, 1½ miles graded across Concession 1 and part of Concession 2, and one mile regraded across Concession 3.

The old road from Swastika to Foster Mine was regraded in places for a distance of four miles.

The Larder Lake road, from Dane Station on the Temiskaming and Northern Ontario Railway, was repaired and culverts and small bridges constructed.

On a visit to the Ontario Government Experimental Farm, Monteith, T. & N. O. Ry. Oats yield 70 bushels per acre.

Constructing the Matheson Bridge, 650 feet long.

Road between Concessions 4 and 5, from Lot 2 to townline, Twp. of Taylor, ¾ mile graded; and 1 mile graded across Concession 4 on town line between Carr and Taylor.

Road between Concessions 4 and 5, Twp. of Taylor; one mile chopped, stumped and grubbed across Lots 11 and 12. Also on Concessions 4 and 5 in Stock, one mile chopped, stumped and grubbed across Lots 1 and 2. Also on road between Taylor and Stock, one mile chopped, stumped and grubbed across Concession 3.

Road between Concessions 1 and 2, Twp. of Walker, across Lots 4 to 10, 3½ miles improved with grader; also ½ mile between Lots 10 and 11, Concession 2; also one mile graded from line between Lots 10 and 11, across Lots 11 and 12, to the town of Monteith; also ½ mile chopped and graded between Lots 10 and 11 north to Concession 3; also chopped, stumped and grubbed 2½ miles between Concessions 2 and 3, Walker; two miles graded, ½ mile chopped and graded from Concessions 2 and 3, between Lots 10 and 11.

Road between Concessions 3 and 4, across Lots 1, 2, 3 and 4, Bowman; two miles chopped, stumped and grubbed.

Road between Concessions 5 and 6, Hislop, across part Lots 9 and 10, one mile graded, ½ mile chopped across Lot 8. Also 1 mile chopped across Concession 5, between Lots 10 and 11.

Road between Twps. of Taylor and Carr, ½ mile graded across N. half, Concession 2.

Road between Taylor and Walker; ½ mile chopped, stumped and grubbed.

Road between Concessions 5 and 6, Stock; chopped, stumped, and grubbed, one mile across Lots 6 and 7; also ¼ mile graded on Lot 3.

Cut down hill between Lots 4 and 5, Twp. of Bowman, south from Matheson, on Concession 5.

Road between Concessions 1 and 2, Twp. of Beatty; two miles chopped across Lots 9, 10, 11, and 12.

Road between Lots 4 and 5, Twp of Carr; cutting down hills, across Concessions 2 and 3.

A new pile bridge was constructed across the Black River at Matheson, 650 feet long, with two 60 foot spans and twenty 28 foot bents. Also a bridge across Russell Creek ½ mile north of Matheson, having a length of 300 feet built on piles, bents 28 feet long. The approaches to each bridge were graded down and a rock filled abutment placed at the south end of the Matheson bridge.

ROADS CONSTRUCTED ALONG THE LINE OF THE TRANSCONTINENTAL RAILWAY, EAST AND WEST OF THE TOWN OF COCHRANE, AND SOUTH ALONG THE TEMISKAMING AND NORTHERN ONTARIO RAILWAY, TO MONTEITH AND TIMMINS.

Number of miles of new road cut out (of which 50.67 miles were graded)......	56.57
Number of miles of old road regraded	27.50
Number of miles of old road burned	40.00
Number of bridges built	12

Township of Bradburn:

Road between lots 12 and 13, across Concessions 7, 8, 9, 10, 11 and 12, a distance of 4.7 miles. This road was cut last season (1913) but not all burned off. The burning and logging has been completed this season (1914).

Farm in the Township of Marter.

Rossing Pulpwood on T. & N. O. Railway, near Cochrane.

Road between Concessions 6 and 7, across Lots 1 to 22 to the Mattagami River, 6.75 miles. This road was cut last season but not all burned off. Burning and logging was completed this season.

Township of Calder:

Road along the west boundary. This road was cut out last season but burning was not completed on 6½ miles. Burning and logging completed this season.

Road between Lots 16 and 17, across Concessions 7, 8, 9 and 10, three miles. This road was cut and graded this season.

New Roads along the Transcontinental Railway west of Cochrane.

Road between Lots 12 and 13, across Concessions 3 and 4. This road was cut out in 1912 but not completed. This season the grubbing was completed on 1½ miles.

Road between Concessions 6 and 7, across Lots 1 to 12. This road was cut out in 1912 but the grubbing was not all done. This season 1.3 miles of grubbing and two miles of grading was completed.

Road between Concessions 8 and 9, across Lots 13 to 18, 1.9 miles. This road was cut this season and Lots 15, 16, 17 and 18 well ditched and graded 1¼ miles.

Road along the north boundary across Lots 1 to 4, 1¼ miles. This road was cut, grubbed and burned.

Township of Colquhoun:

Road between Concessions 6 and 7, across Lots 18, 19, 20 and 21, 1¼ miles. This road was cut last season but the burning and grubbing was completed this season.

Township of Clute:

Road along the west boundary across Concessions 11 and 12, 1½ miles. The road was cut, grubbed and burned and Concession 8 ditched for ¾ mile.

Road between Lots 18 and 19, across parts of Concessions 4 and 5, ¾ mile. This season the road from the Transcontinental Ry. to the Boskego River was burned off.

Road between Lots 12 and 13, across Concessions 7 and 8, 1½ miles, and across Concessions 1, 2 and part of 3 to the Transcontinental Ry., two miles, ditched and graded.

Headquarters of Northern Development Branch, Cochrane.

A Settler's Clearing, T. C. Ry., west of Cochrane.

Road along the south boundary across Lots 1 to 19, six miles. This road was cut out in 1912-13 and parts graded. This season the road was all well ditched and graded across Lots 1 to 19, both inclusive; a bush fire having destroyed the corduroy laid last season, the road required to be reditched.

Road between Concessions 2 and 3, across Lots 25 to 28 and 13 to 18, 3¼ miles. This road was cut out; and lots 25 to 28 only, 1¼ miles ditched and graded this season.

Road between Concessions 4 and 5, across Lots 1 to 9, from Frederickhouse River west across lots 11, 12, 13, 14 and 15, 4.4 miles. This road was cut, grubbed and burned off this season, and parts of lots 2 and 3 graded.

Road between Concessions 6 and 7, across Lots 25, 26, 27 and 28, 1¼ miles. This road was ditched and graded this season.

Road between Concessions 8 and 9, across Lots 4 to 6, one mile, and 11 to 18, 2½ miles. Lots 4 to 6 were cut last season (1913) but not burned. This season these lots were burned and Lots 11 to 18 cut, grubbed and burned off. Road across Lots 24, 25, 26 and 27, 1¼ miles, cut out and partly burned.

Road between Concessions 10 and 11, across Lots 11 and 12, .6 mile. This road was cut out this season and graded.

Road along the north boundary across Lots 1 to 6, two miles. This road was cut in 1912 but was not all burned or grubbed. This season the grubbing, burning and grading was finished.

Township of Leitch:

Road between Concessions 2 and 3, across Lots 1, 2 and 3, one mile. This road was cut, grubbed and burned this season.

Road between Concessions 6 and 7, across Lot 1, .4 mile. This road was cut last season (1913). This season it was graded and a good bridge, 25 ft. span, erected over a creek on Lot 1.

Township of Blount:

Road between Concessions 6 and 7, across Lot 28, .4 mile. This road was partly cut last season. This season the cutting, grubbing and burning was completed.

Road along the south boundary, across Lots 19 to 28. This road was cut and graded last season. This season the bad spots (owing to the destruction of corduroy by bush fires) on the road were repaired and a new bridge erected over Lillabelle Creek, the old bridge having been destroyed by a bush fire.

Constructing bridge at Frederickhouse River, five miles west of Cochrane; 200 ft. long.

Township of Glackmeyer:

Road along the west boundary. This road was cut and graded in 1912. This season it was in need of repair owing to bush fires and was regraded in places for a distance of 4½ miles.

Road between Lots 18 and 19, across Concessions 1 to 12. This road was cut and graded some years ago. This season parts of the corduroy were badly burned, and Concessions 7 to 12 were regraded, 4½ miles, and the corduroy partly renewed.

Road along the south boundary, six miles. This road was regraded this season owing to partial destruction by forest fires of corduroy in places, and rutting during the wet weather in the early part of the season.

Road between Concessions 4 and 5, Lots 1 and 2 to the Abitibi River and Lots 25 to 28 were cut this season. Lots 3, 4 and 5 and part of 6 were graded, also Lots 26 and 27, 1¾ miles.

Road between Concessions 8 and 9, across Lots 13 to 18, were cut and graded, two miles this season, and Lots 19 to 28, 3.2 miles, graded. A 50-foot pile bridge was erected over Lillabelle Creek on Lot 23.

Road between Concessions 10 and 11, across Lots 13, 14 and 15, one mile. This road was cut last season (1913) but the burning was not completed. This season the burning was finished and two culverts constructed on Lot 13.

Township of Kennedy:

Road along the west boundary, a distance of 1.7 miles, across part of Concessions 3, 4, 5 and 6. This road was cut last season but the burning not finished. This season the burning was completed.

Road between Lots 12 and 13, across Concessions 7 and 8, 1½ miles. This road was cut last season (1913) but the burning was not finished. This season the burning was completed.

Road between Concessions 4 and 5, across Lot 27, .3 mile. This road was cut out and burned.

Road between Concessions 6 and 7, across Lots 1 to 16, five miles. This road was cut last season and partly burned; the burning was completed this season.

Township of Fournier:

Road between Lots 10 and 11, across Concession 6, one mile. This road was cut, burned and grubbed this season.

Road between Lots 8 and 9, across Concession 6, 1¼ miles. This road was cut, grubbed and burned off this season.

Road between Lots 4 and 5, across Concession 6, ½ mile. This road was cut, grubbed and burned off this season.

Road between Concessions 3 and 4, across Lots 1, 2, 3 and 4, two miles. This road was cut, grubbed and burned off this season.

Township of Lamarche:

Road along the west boundary across Concessions 2 to 6. This road was cut and partly ditched last season. This season 2½ miles of the road was graded; and part of the road which was graded and corduroyed last season, but was burned by bush fires, was this season repaired.

Road between Lots 10 and 11, across Concessions 4, 5 and 6, three miles. This road was cut and graded.

Road between Lots 8 and 9, across Concessions 1 and part 2, 1½ miles. This road was cut in 1913 and this season it was burned and graded.

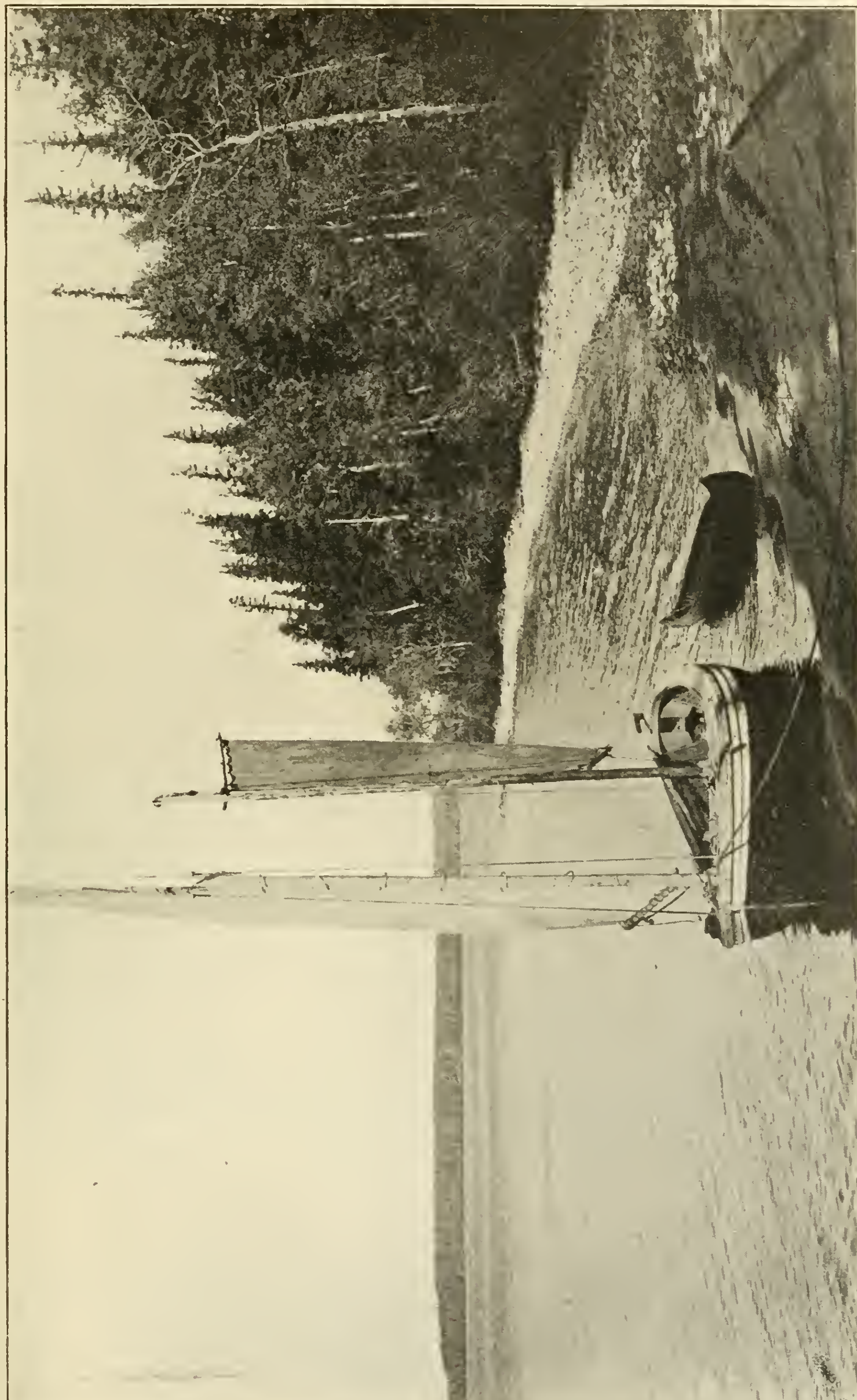
Road between Lots 6 and 7, across Concessions 2 to 5 and part of 1, 4¾ miles. This road was cut last season. This season the road was all burned off and graded. Two pile bridges, one on Concession 2 and one on Concession 3, were constructed.

Road between Concessions 1 and 2, across Lots 5 and 6, one mile. This road was cut and graded. A pile bridge was erected over Wicklow River on Lot 3.

Road between Lots 2 and 3, across Concessions 4, 5 and 6, three miles. This road was cut by the Colonization Branch in 1912 but not burned or ditched. This season the road was graded.

Township of Brower:

Road along the west boundary, across Concessions 5 and 6, two miles. This road was regraded this season, the forest fire of 1914 having burned out the corduroy.



Beautifully wooded shore of Coney Island in Lake Abitibi.

Road between Lots 10 and 11, across Concession 6, one mile. This road was cut and graded this season.

Road between Lots 6 and 7, across Concession 4, one mile. This road was cut and graded from Transcontinental Ry. south 50 chains this season, and cut and grubbed north of Transcontinental Ry. 30 chains.

Road between Lots 2 and 3, across Concessions 3 to 6, four miles. This road was regraded this season.

Road between Concessions 2 and 3, across Lots 1 and 2, one mile. This road was regraded this season.

Road between Concessions 3 and 4, across Lots 5 to 10, two miles. This road was cut last season (1913). This season the burning was completed and the road graded across Lots 6 to 9.

Road between Concessions 4 and 5, across Lots 9 to 12. This road was cut by the Colonization Branch in 1912; and this season 1½ miles was burned off, Lot 12 partly ditched and a pile bridge erected over Brule Creek on Lot 11.

Road on Concession 4, from Abitibi Station east to road between Lots 6 and 7, ½ mile. This road was cut, grubbed and burned off this season.

Township of Fox:

Road along the west boundary, across Concessions 1 and 2, two miles. This road was cut in 1912, and this season the road was graded and a bridge erected on Concession 2 across a small stream.

Road between Concessions 2 and 3, across Lot 12 to Transcontinental Ry., ¼ mile. This road was cut and graded this season.

Township of Clergue:

Road between the north and south half of Lot 10, Concession 6, from the side road between Lots 10 and 11 to Porquois Junction Station on the Temiskaming and Northern Ontario Ry., ½ mile. This road was graded this season.

Road between Concessions 5 and 6, across part of Lot 9, Lots 10, 11 and 12, 1¾ miles. This road was cut and partly grubbed and burned off this season.

Road between Lots 10 and 11, across Concession 6, one mile. This road was cut by the Colonization Branch in 1912. This season it was all burned and grubbed, and the north half graded.

Road along the east boundary, across Concessions 4, 5 and 6, three miles. This road was cut 1912-13 and this season the burning was completed.

Road along the east side of the Temiskaming and Northern Ontario Ry. from Monteith to Porquois Junction. This road was started last season (1913). This season the road was completed and three bridges constructed across small creeks. 5¾ miles grading. 2¼ miles cut out.

Township of German:

Road between Lots 10 and 11, across Concession 5 and part of Concession 6, 1¾ miles. This road was cut, grubbed and burned off this season.

Road between Concessions 4 and 5, across Lots 11 and 12, one mile. This road was cut, grubbed and burned off this season.

Road along the west boundary, across Concessions 4 to 1, 4¼ miles, to Night Hawk Lake. This road was cut, grubbed and burned off this season.

Guard at Interned Aliens' Camp, Kapuskasing.

Interned Aliens at Work Clearing Experimental Farm at Kapuskasing, 70 miles west of Cochrane.

Townships of Shackleton and Fauquier:

Road along the north limit of the Transcontinental Ry. from the Ground Hog River west to Moonbeam Station, seven miles. This road was cut last season. This year seven miles were burned off and ditched and graded from Ground Hog River west for 2½ miles.

Street in the Town of Cochrane, the approaches to the road around the south end of Commando Lake, ¼ mile. Grading and cutting down hills.

Ferry on the south boundary of the Township of Glackmeyer. A ferry was constructed over Abitibi River, 16 ft. x 28 ft., operated by a cable 400 feet long, capable of conveying passengers and teams.

Bridge, 200 feet long on the south boundary of the township of Clute, over the Frederickhouse River, was constructed on three piers filled with rock.

Road in the Townships of Whitney and Tisdale between the towns of Porcupine and Timmins. That portion of the old road built some years ago between Porcupine, Golden City on the Temiskaming and Northern Ontario Ry. and South Porcupine was surfaced with gravel and stone from the mines 2½ miles; 2½ miles between South Porcupine and Schumacher was regraded and surfaced with gravel and stone, and ¼ mile near Schumacher and the McIntyre Mine stoned. A bridge across a creek on Lot 5, Concession 2 and 3, Tisdale, was constructed.

Road in the Townships of Tisdale and Delora, from the Town of Timmins to the Hollinger Reserve Mine. This was an old road, and this season the bad spots were repaired, old crosslay replaced and in several places the road was shortened. This road is about three miles in length and has an average width of twenty-five feet.

A winter mining road from Earlton Branch of Temiskaming and Northern Ontario Ry. from the foot of Elk Lake, southerly to mines in the Maple Mountain District, having a length of twelve miles was cut out.

ROADS IN THE VICINITY OF THE TOWN OF HEARST, TRANSCONTINENTAL RY.

New roads cut out, not graded	15.75 miles
Roads graded, new and old	19.5 "
Roads burned and grubbed only	5.2 "

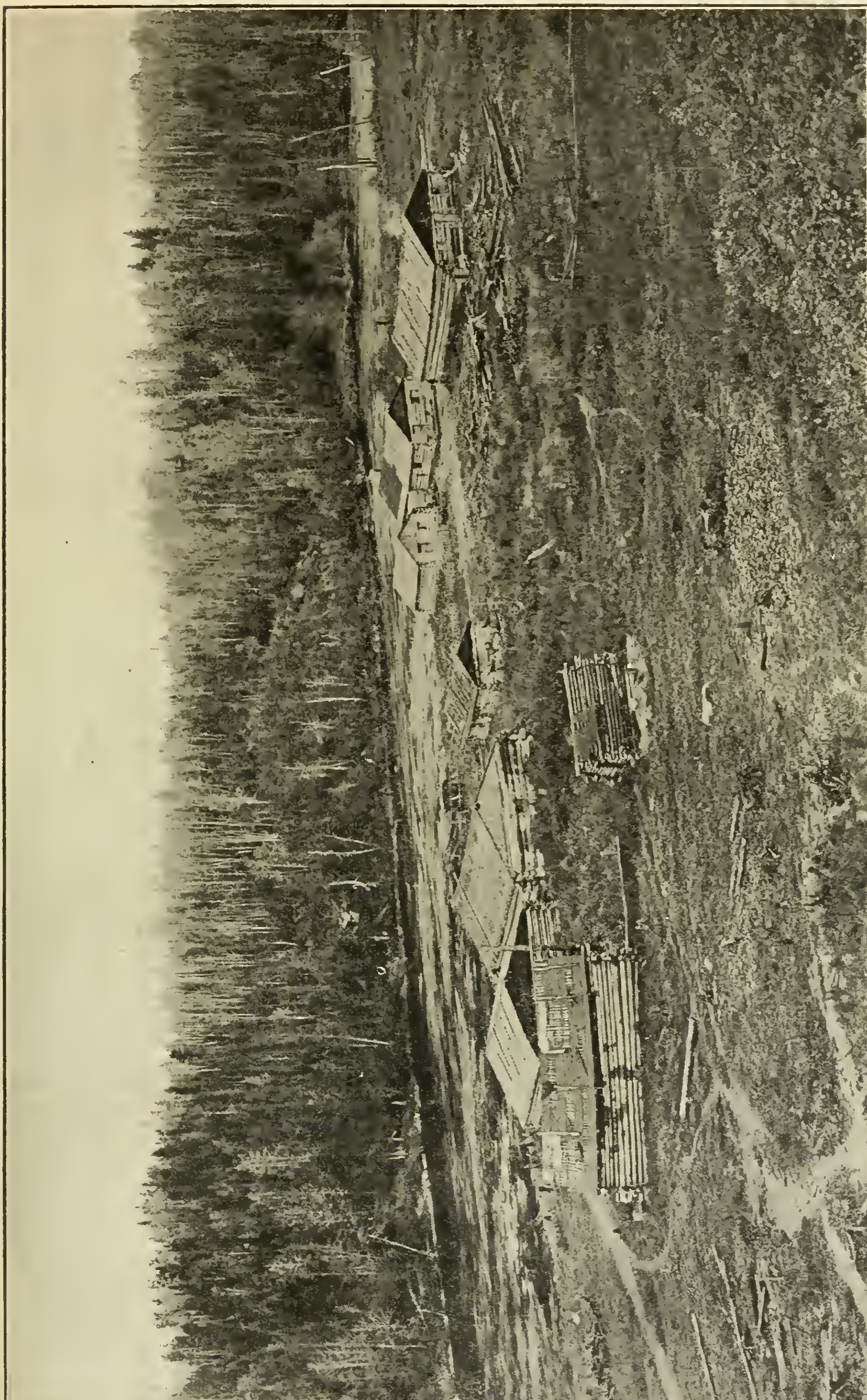
Road along the north side of the Transcontinental Ry., across the township of Kendall and part of the townships of Way and Hanlan. This road was cut last season. This year six miles in Kendall were graded and half-mile in Way; also 3½ miles additional burned and grubbed.

Township of Casgrain:

Road across the west boundary across part of Concession 1, .15 of mile of this road was graded.

Road between Lots 24 and 25, across Concessions 1 and 2, 1½ miles of this road was cut, grubbed, and burned off this season.

Road between Lots 18 and 19, across Concession 1, ¾ mile. This road was cut, grubbed and burned off this season.



The clay banks of the Nagagami River, Transcontinental Railway, 170 miles west of Cochrane, another of Northern Ontario's fine speckled trout streams, showing the Transcontinental Railway construction camps.

Road along the south boundary, across Lots 13 to 29. This road was cut last season. This year $3\frac{1}{2}$ miles across Lots 14, 15, 16, 17, 18, 23, 24, 25, 26, 27 and 28 were graded and 1.7 miles burned.

Road between Concessions 2 and 3, across Lots 15 to 28, $3\frac{1}{2}$ miles. This road was cut, grubbed, and burned off this season, with the exception of Lot 27.

Constructing bridge across Mattawishquia River near Hearst.

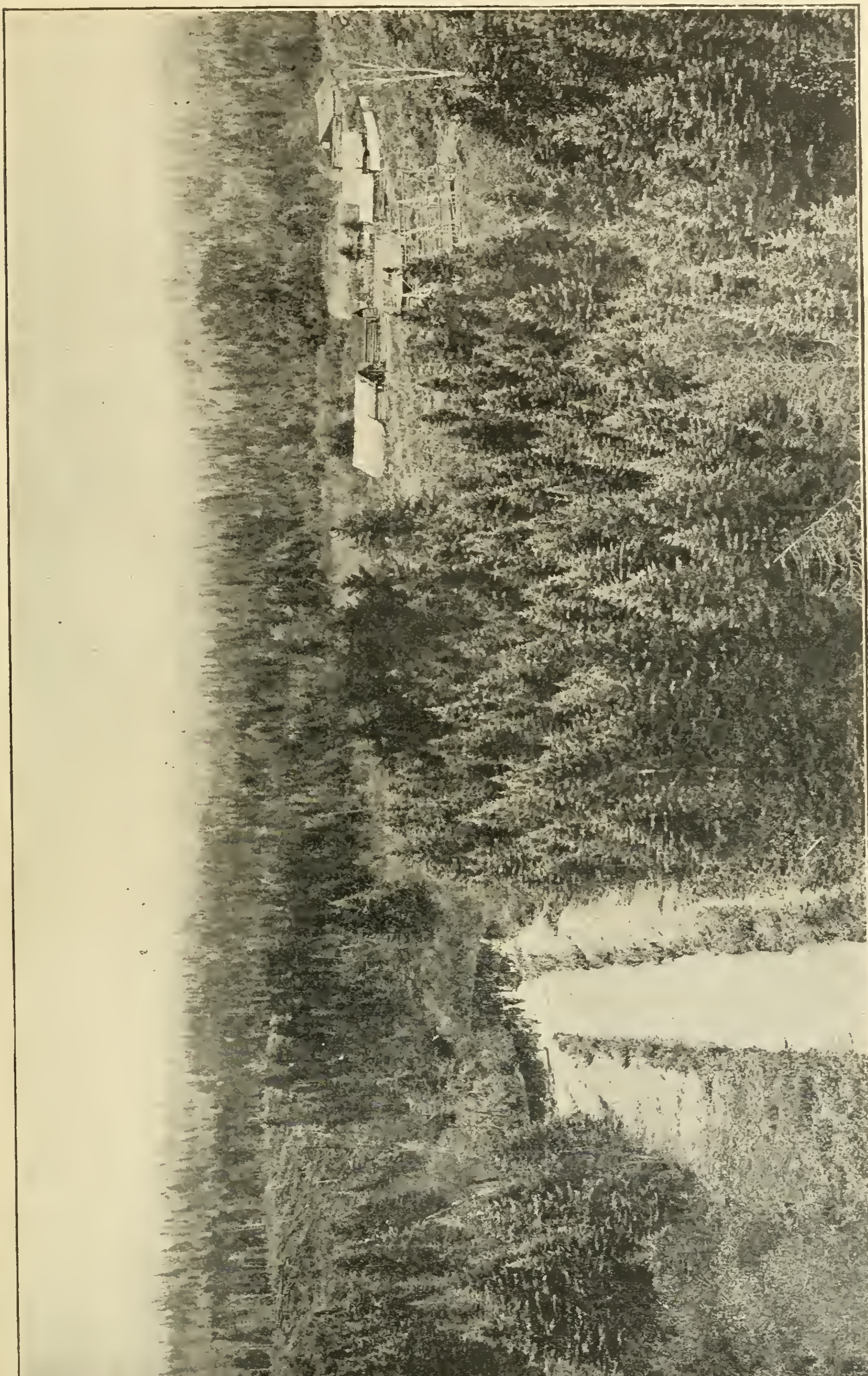
A view along the Kapuskasing River between Cochrane and Hearst on the Experimental Farm.

Township of Kendall.

Road along the west boundary, across Concessions 9 to 12, three miles. This road was cut out last season and graded this season.

Road between Lots 24 and 25, across Concessions 11 and 12, $1\frac{1}{2}$ miles. This road was graded this season.

Road between Lots 18 and 19, across parts of Concessions 10, 11, and 12, two miles. This road was cut, grubbed and burned off this season.



Skunk River, Transcontinental Railway, 168 miles west of Cochrane, showing the splendid clay lands in the valley, and one of Northern Ontario's fine speckled trout streams.

Road between Lots 12 and 13, across Concessions 7 to 10, 2.1 miles was graded this season. The road was cut out last season.

Road between Concessions 8 and 9, across Lots 13 to 29, 5¼ miles. This road was cut, grubbed, and burned off this season.

Road between Concessions 10 and 11, two miles. Lots 19, 20, and 21 were cut and burned this season, and Lots 22, 23, and 24 were graded this season, the cutting having been done last season.

Road along the west and east banks of the Mattawishquia River from the Transcontinental Ry. north across part of Concessions 10, 11 and 12, 2¼ miles. This road was cut and one half grubbed and burned off and half-mile graded this season.

A bridge across the Mattawishquia River, north of the Transcontinental Ry., was partly constructed, three rock-filled piers, abutments and stone approaches have been completed. The river is 100 feet wide. The bridge will be completed in March. The bridge, when completed, will give to the settlers east along the railway access to Hearst.

Streets in the Village of Hearst. Front and Ninth Streets were regraded 1¼ miles. This was necessary owing to the destructive forest fire which swept over the town, burning out all culverts and corduroy laid last season.

A trunk sewer was constructed on 9th Street from Front Street south to the Mattawishquia River, a distance of 2,200 feet, also one along George and 10th Streets, 1,320 feet.

During the months of July and August two forest fires swept over the town of Hearst, destroying all the buildings in the town, except the Transcontinental Ry. station and round-house, a few small shacks, and one cottage. In one of the fires the office and store-house of the Northern Development Branch, constructed last season, including supplies and camp equipment valued at $850 was destroyed. A small building has since been constructed to store supplies in.

EXPERIMENTAL FARMS AND GARDEN PLOTS.

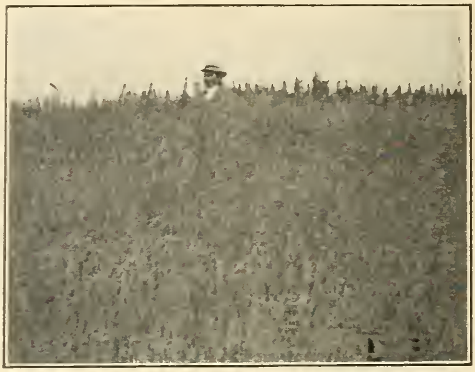
At Groundhog River on the Transcontinental Railway, 50 miles west of the Town of Cochrane, an experimental garden was started. At this point the railway contractors have grown vegetables successfully for the last four or five years. The buildings occupied by the contractors were secured by this Branch and are now used as headquarters for work along the Transcontinental Railway between Cochrane and Hearst.

About the 1st of May, operations were started by cutting down and clearing off about 5 acres of land adjoining the small garden plot cleared by the railway contractors. The land was heavily timbered with spruce, balm of gilead, poplar and white birch, and is situate along the west bank of the Groundhog River south of the railway rising gradually from the water's edge to a height of about 25 feet. The soil is a rich brown clay and clay loam, overlaid with about six inches of black loam. Plots of Spring wheat, barley oats, peas, potatoes and all kinds of vegetables were put in and ripened well giving a good production. Potatoes were planted at different periods from May 19th to July 1st. The Irish Cobbler planted 27th of May gave a yield of 192 bushels per acre: the Early Rose planted

Bridge over Wahtaybeg River, North of Matheson.

June 8th yielded 268 bushels per acre; the Delaware yielded 175 bushels per acre. The potatoes planted July 1st yielded 102 bushels per acre.

All vegetables such as radishes, carrots, garden peas, watermelons, parsnips and lettuce grew abundantly. The white and yellow Dutch onion setts yielded 242

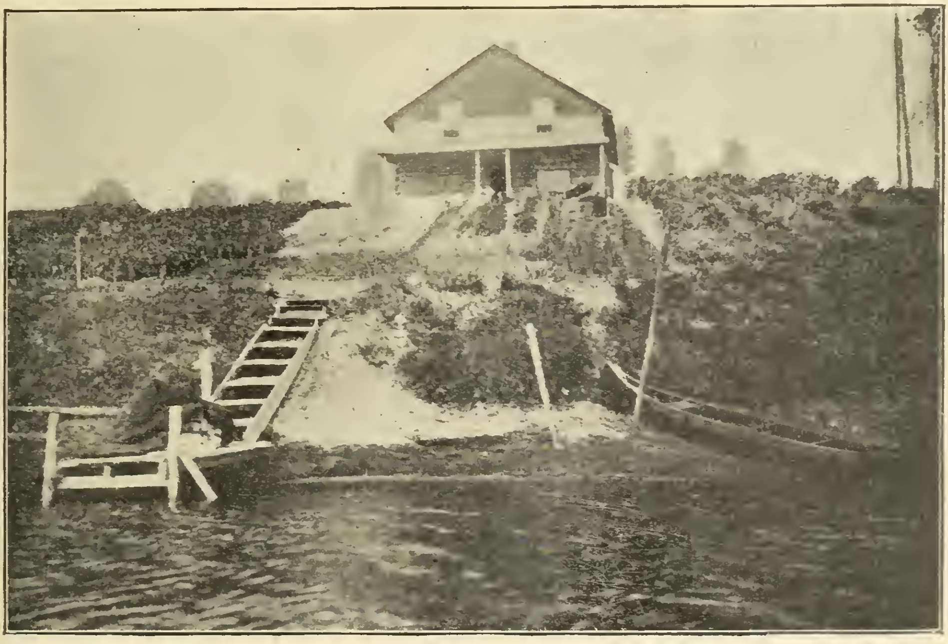


Field of Rye on the Northern Development Experimental Farm, Cochrane.

Onion Bed, experimental plot at Ground Hog.

bushels per acre, planted on the 29th of May. Strawberry plants, gooseberry, red raspberry and red currant bushes planted on the 27th of May gave every indication of being productive. Cabbages also grew abundantly, the larger ones having an average weight of 16 pounds, many of them weighing from 20 to 24 pounds, and

A view of the Northern Development Experimental farm plot on the Ground Hog River.



Headquarters of the Northern Development Branch, showing garden plot, Ground Hog River, T.C.R.

a few of them as high as 30 pounds. Wheat, peas, barley and oats ripened and gave a good yield.

Besides the garden plot near the Groundhog River a farm was located about 2 miles west of the river where the soil is a clay loam with about five inches of rich humus on the surface and the land gently rolling; the country was partially burned over several years ago and is now grown up with a second growth of poplar and spruce. The work on this farm was commenced about the 1st of May and 12 acres of spring crop sown. Seed planting was begun about the middle of May; 7 acres were plowed and put into Spring wheat, oats, barley, peas, rye, potatoes, turnips and other vegetables. In addition 5 acres were cleared, disced and harrowed and different varieties grown on this as a test. Spring wheat was sown on the 16th of May, and oats, barley, peas and rye sown at intervals during the balance of the month. Each variety ripened and gave a sufficient yield to en-

Headquarters of the Northern Development Branch at Ground Hog River, T. C. Ry., showing experimental garden.

courage settlement. Turnips, beets, carrots, parsnips and radishes gave a splendid yield and fully matured by September 2nd. On the low land, however, the potatoes were injured by summer frosts on or about the 1st of August.

On the garden plot on the bank of the river, beans and corn were injured by summer frosts before maturing, also tomatoes, watermelons and cucumbers.

Clover and timothy grew in great abundance both at the garden plot and farm. Rye grew to a height of over six feet.

During the months of August and September a further area of 14 acres was cleared and cultivated, and 4 acres of it sown in Fall wheat and 1 acre in Fall rye; this was sown on the 21st of August. The Fall wheat and rye got a good strong growth before the snow fell and had every appearance of being able to withstand the winter.

On the west farm there is now about 30 acres ready for spring crop. A small area of Fall wheat was also sown on the garden plot.

At the Town of Hearst at the junction of the Algoma Central Railway and the Transcontinental Railway, different kinds of grain and vegetables were planted and had every indication of a good yield. Unfortunately, however, a forest fire which swept over that section of the country, burning out almost the entire town, reached our garden and farm plots and completely destroyed the grain and vegetables.

On Lot 27, Concession 1, Township of Glackmeyer, about 1 mile west of the town of Cochrane, an experimental plot was rented where the land is comparatively level, the original forest growth being almost entirely spruce. The land had been burned over and partially cleared a year ago. Operations were commenced about

Another view of the Ground Hog experimental garden.

the middle of May and all kinds of grain and vegetables planted. Wheat, barley, peas, rye and oats were sown between the 14th of May and the 1st of July; they all matured and ripened before the middle of September. As the land was low lying and had from six inches to eight inches of vegetable mould on the surface, there was an abundant growth of straw. The grain was well filled and would compare favorably with crops grown in the best sections of older Ontario. Potatoes, onions, cabbages, beets, carrots, parsnips, radishes and turnips were also a first-class crop. Beans, corn and tomatoes were injured by the summer frosts about the 1st of August and did not mature. Beets, cabbages and onions were an exceptionally fine crop. This particular farm lot was selected to test the character of the soil on the low lying land in the district; the land before it was cleared had every appearance of a swamp; on the lot there was a small area of about a quarter of an acre of timothy and clover which yielded a splendid crop.

At the headquarters of the Northern Development Branch at the east end of the Town of Cochrane, all kinds of grain and vegetables were planted. The land is situate between two small lakes at an elevation of 20 feet above the water. To the south of the garden plot is a virgin forest of white birch, poplar, and spruce. The land is a clay loam well drained, but had not been cultivated heretofore. A splendid sample of Spring wheat was produced and exhibited at the Toronto Exhibition. All other kinds of grain matured about the end of the first week in September, except a late variety of peas. At this garden there was no sign of summer frosts until about the middle of September. Garden peas and beans ripened, and corn was a fair crop, fit for table use, but did not ripen. All classes of vegetables gave a good yield.

Throughout the district there were several summer frosts which injured vegetables, including potatoes, more particularly on the low lying lands or where

Cabbage, weighing 30 lbs, grown on Ground Hog experimental plot, T. C. R.

the land had not been properly cultivated; but as far as I could judge in visiting different parts of Northern Ontario, from the Rainy River Valley to the Ottawa River and along the north shore of Lake Huron, I find that the injury done by summer frosts in the Claybelt was no greater than that done in other sections; and from my observations, the crops were as good in the Claybelt as in most sections north of Parry Sound.

The soil is exceptionally suitable for the growth of timothy and clover. With proper cultivation, where large areas are cleared off, I am convinced that there will be no difficulty in growing all kinds of grain and vegetables. Where fall wheat was grown it matured; the crop was exceptionally good and in no instance did I find it had received injury from summer frosts.

J. F. Whitson,

Commissioner.

NOVEMBER 18TH, 1914.

THE HONORABLE THE PREMIER.

SIR,—I beg to recommend the expenditure of the following amounts under 2 Geo. V. Chap 2, on the construction of new roads, repairing and finishing of old roads, the construction of bridges and the operation of the Experimental Farm at Ground Hog River, 52 miles west of the Town of Cochrane on the Transcontinental Railway, the Experimental Farms and gardens at Cochrane and Hearst.

District of Rainy River.

In the Rainy River Valley, to complete and re-surface roads constructed last season, also the opening up of new roads tributary to the trunk roads constructed last season $35,000

District of Kenora.

The construction of new roads in the agricultural section north-east and north-west of Dryden and in the valley of the Wabigoon River in the vicinity of the Grand Trunk Pacific Railway and along the Canadian Pacific Railway east of Kenora 25,000

District of Port Arthur.

Re-surfacing trunk roads graded last season and the construction of short roads adjacent to the trunk roads, also construction of new roads, north of the Township of Dorion along the Canadian Pacific Railway .. 40,000

District west and south of Fort William.

The completion and extension of the trunk roads begun last season and re-surfacing and gravelling portions of the trunk roads partly constructed last season, including the Pigeon River or International Boundary and Duluth Road, also the completion of the bridge across the Kaministiquia River at Kakabeka Falls 50,000

Sudbury and Sault Ste. Marie Trunk Road.

Improving and gravelling parts of trunk roads between Bruce Mines and Cuttler, partly under construction last season 50,000

District of Sudbury.

Re-surfacing parts of trunk roads constructed last season in the Blezard and Chelmsford Valleys, construction of short roads through the Blezard Valley, the completion and extension of the West Shining Tree Mining Road and the repairing of Long Lake Mining Road, also construction of road from Coniston Village South to the Industrial Farm in the Township of Burwash 40,000

Sudbury and North Bay Road.

The construction of a trunk road from the Town of Sturgeon Falls west to near the Town of Sudbury 50,000

District of Nipissing.

The construction of trunk road through the Indian Reserve between the towns of North Bay and Sturgeon Falls, partly constructed in 1914. To cover one-half of cost 20,000

The completion of the trunk road from the Village of Callander South to the Town of Powassan, also the completion of a trunk road from near Callander through the Township of Chisholm 15,000

Haileybury and South Lorrain.

The completion of the trunk road through the mining and agricultural district south of Haileybury 8,000

Mining road from Elk Lake Branch of the Temiskaming and Northern Ontario Railway to Maple Mountain Mining Section and other mining roads in the vicinity of Elk Lake 15,000

The completion of the South Porcupine and Timmins mining road and other mining roads in the vicinity of Porcupine 12,000

Colonization roads in the vicinity of Long Lake west and north of the Village of Charlton 20,000

Temiskaming and Northern Ontario Railway.

Roads along the Temiskaming and Northern Ontario Railway from Earlton north to Cochrane and extending west as far as Charlton and Porcupine and east as far as the agricultural lands extend, including the construction of a bridge over the White River 90,000

Transcontinental Railway.

Roads along the Transcontinental Railway from the Quebec boundary west to the Town of Hearst, to cover the completion of roads cut out last year, the construction of new roads where settlement has taken and is taking place, the completion of bridges across the Frederickhouse River near Cochrane and the Mattawishquia River near Hearst 75,000

The completion of the road from Pembroke to the Petawawa Military Camp 10,000

The extension of the Mattawa-Pembroke trunk road east from Mattawa	5,000
For the operating of the experimental farms at Ground Hog River on the Transcontinental Railway, and at Cochrane and Hearst which were begun last year with a view to testing the climatic conditions of these sections of the country	3,000
Unforeseen work, exploration and surveys of new roads, renewing of old bridges and construction of new roads	32,000
Office and engineering expenses, equipment and plant	20,000
	$615,000

I have the honour to be, Sir,

Your obedient servant,

J. F. WHITSON,

Commissioner.

TWENTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO BUREAU OF MINES, 1915,

BEING

VOL. XXIV. PART I.

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PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY OF ONTARIO

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1915

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TORONTO

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LETTER OF TRANSMISSION

To His Honour John Strathearn Hendrie, C.V.O.,
Lieutenant-Governor of the Province of Ontario.

Sir,—I have the honour to transmit herewith, for presentation to the Legislative Assembly of the Province of Ontario, the Twenty-fourth Annual Report of the Bureau of Mines.

I have the honour to be, Sir,

Your obedient servant,

G. H. Ferguson,
Minister of Lands, Forests and Mines.

Department of Lands, Forests and Mines,
Toronto, 1915.

INTRODUCTORY LETTER

To The Honourable George Howard Ferguson, K.C.,
Minister of Lands, Forests and Mines.

Sir,—I have the honour to present to you herewith, to be transmitted to His Honour the Lieutenant-Governor in Council, the Twenty-fourth Annual Report of the Bureau of Mines, being for the calendar year 1914.

The Report consists of three Parts.

Part I comprises a Statistical Review of the Mining Industry of Ontario for 1914; a Report on the Mining Accidents of the year by Mr. T. F. Sutherland, Chief Inspector of Mines; an account of the working mines of Ontario and their operations during the twelvemonth, by Mr. Sutherland and Inspectors Collins, Bartlett and McMillan; a description of the Beatty-Munro Gold Area, by P. E. Hopkins of the geological staff of the Bureau; a paper on the Productive Area of the Michipicoten Iron Ranges, by Arthur L. Parsons of the University of Toronto; notes on the geology and mineralogy of the North Shore of Lake Huron, by Cyril W. Knight, Assistant Provincial Geologist; and a discussion of Metallogenetic Epochs in the Pre-Cambrian of Ontario, by Professor W. G. Miller, Provincial Geologist. The several reports of a geological nature are accompanied by appropriate maps and plans, both geologically coloured and in black and white.

Part II, entitled Oil and Gas in Ontario, by Mr. Knight, was primarily compiled for the purpose of presenting in convenient form records of wells drilled in the Province for oil and gas. Most of the logs have already been published in the annual reports of the Bureau of Mines and the Geological Survey of Canada, or in the Transactions of the Canadian Mining Institute. Nevertheless, requests for information regarding the wells have made it advisable to gather all the available records under one cover, especially as a number of the reports referred to are now out of print, and others may not be readily accessible to those in search of information. Many logs hitherto unpublished have been added. The Report is prefaced by a brief reference to the origin of oil and gas, and by short descriptions of the areas in Ontario in which these valuable products occur.

Part III consists of a Report (third edition), by A. G. Burrows, one of the Bureau's geologists, on the Porcupine Gold Area. In this Report on Ontario's most important gold field, Mr. Burrows gives the results of further study of the age relations of the rocks, the character of the ore bodies, and the progress in mining. The Report is accompanied by more detailed maps than those hitherto published on this area.

The statistical tables printed in Part I of the Report show that there was a considerable falling off in the value of the mineral production of the Province in 1914 as compared with the previous year. The causes leading to this decrease are dealt with in the Report. Silver and nickel have in the past held the leading places in the tables of metallic production. Silver is now diminishing in yield, and it is satisfactory to note that this loss in production is being made up by the growing output of gold. This is mainly due to the Porcupine group of mines, the development of which on the whole has been very satisfactory. Further discoveries of gold have been made which indicate that other areas are likely to contribute to the yield. Kirkland lake is already doing so, and the finds at Goodfish lake, in Boston township, north of Schreiber on the main line of the Canadian Pacific railway, and elsewhere, are worthy of serious attention. A promising discovery has been made since the beginning of 1915 and before the present Report was finally off the press, of which a word may here be said. This was near Howard falls on the Kawaskagama river, which crosses the National Transcontinental railway 300 miles west of Cochrane. The railway station called "Kowkash"—an abbreviation or corruption of Kawaskagama—has given its name to this area. Spectacular gold in quartz was found here by Mr. E. W. King Dodds on 21st August, 1915. Mr. P. E. Hopkins was despatched to the spot to make a preliminary investigation, and the map which accompanies Part I, with geological annotations, gives the gist of his observations. The Keewatin rocks in which the gold occurs are covered

with a dense growth of small timber and moss, which with the numerous loose boulders makes prospecting difficult. The area is now being prospected, and should additional finds be made a fuller examination of the field will be desirable.

Remarkably rich quartz was encountered in developing the Dobie-Leyson claim on lot 10 in the first concession of the township of Munro. Some of this material was exhibited in the display of minerals made by the Bureau of Mines at the Canadian National Exhibition, Toronto, in 1915, and naturally excited much interest. It was estimated to contain 2,000 or 2,500 ounces of gold per ton. About 2,000 pounds weight of quartz of this quality was said to have been taken from the shaft, which at time of writing (September, 1915) is still being sunk.

I have the honour to be, Sir,

Your obedient servant,

THOS. W. GIBSON,
Deputy Minister of Mines.

BUREAU OF MINES,
DEPARTMENT OF LANDS, FORESTS AND MINES,
Toronto, 1915.

STATISTICAL REVIEW

of the

MINERAL INDUSTRY OF ONTARIO FOR 1914

By Thos. W. Gibson, Deputy Minister of Mines

Statistics in relation to an industry are like the barometer in relation to the weather. They show its condition, and the changes which are taking place; they also give some indication of what may be expected in the near future. They reflect the influence of passing events, whether on the Provincial, national or world stage. They disclose the birth and development, and sometimes the decline, of any particular branch or department. It is of consequence therefore that the data for a statistical view of any industry should be collected with care and presented with accuracy to the end that the deductions drawn from the figures may be such as are warranted by the facts.

Applying the statistical standard and taking successive five-year periods, we find that in 1891, when the Bureau of Mines was established, the total value of the mineral production of Ontario was $4,705,673; in 1896 it was $5,235,003; in 1901, $11,831,086; in 1906, $22,388,383; in 1911, $41,976,797; in 1913, $53,232,311, and in 1914, $46,295,959. The rate of growth expressed by percentages for the several periods was as follows:—

Period	Growth per cent.
1891 to 1896	11.2
1896 to 1901	125.9
1901 to 1906	89.2
1906 to 1911	87.4
1911 to 1914	10.2

It will be seen that the output in 1913 was over eleven times in value that of 1891, and that even the reduced production of 1914 was worth nearly ten times the yield of 1891.

The list of the mineral products of this Province is an unusually long and varied one, and new products are constantly being added. In 1891 the substances produced numbered 15, and in 1914, 32. Important industries have been built up during the last 20 years in the production of the following minerals, entirely wanting in the earlier tables of output: arsenic, calcium carbide, cement, corundum, feldspar, graphite, iron pyrites, natural gas, quartz, sewer pipe and talc. In a number of the metals, notably nickel, copper, silver and gold, the development has been very great; indeed in the case of silver, it may be described as phenomenal. The pig iron industry has during the same period been firmly established, notwithstanding its dependence upon foreign sources for ore supplies, and from the by-products of the silver mines the refineries of Ontario have acquired control of the world's trade in cobalt oxide. The single exception to this rule of growth is petroleum, the Lambton oil fields now yielding less than one-quarter of their output 25 years ago.

Moreover, it is far from impossible that the list of Ontario's mineral products may yet have still further additions. Mercury, tungsten, platinum, chrome iron ore, asbestos and even diamonds have been found in the pre-Cambrian rocks of northern Ontario, albeit none of them in workable deposits. In these largely virgin wilds some future

prospector, more diligent or more fortunate than his fellows, may perhaps find that in some at least of these substances nature has been no less bountiful than she has in the same regions with her treasures of silver, gold and nickel. And in the Silurian and Devonian rocks of the Hudson Bay slope there seems to be no good reason why we may not look for reservoirs of petroleum and natural gas and beds of salt corresponding to those now being worked in formations of similar age and character in southwestern Ontario. The counterparts of the gypsum deposits of the Grand River valley—apparently on a larger scale—have already been located on the banks of certain tributaries of the Moose.

The Production of 1914

The production of minerals for 1914 was less in value than for 1913 by $6,936,352, or 13 per cent. The falling off is considerable, yet the causes are not far to seek. Early in 1914 it became evident that a business depression was setting in, which in any event would have led to a lessened output of certain of the mineral products, notably pig iron and all materials of construction such as bricks, cement, etc. Other articles on the list would also have suffered from the same cause. In addition, it is recognized that the silver mines of Cobalt have passed their zenith, and in any circumstances—except possibly the occurrence of a very high price for silver—the output of silver would have been less than in 1913.

But all these causes were gathered up and given additional weight by the outbreak of hostilities in Europe—hostilities which from their extent and the ferocity with which, on one side at least, they have been waged, will surely be remembered in history by the name of the Great War. Silver mining was temporarily paralyzed, and the Canadian Copper Company shut down four of its six nickel-copper furnaces. Capital was frightened, and money could not be borrowed to carry on going concerns, to say nothing of opening up new enterprises. Prices of products dropped, and the cost of supplies went up. Some kinds indeed could not be had at all, or only in insufficient quantity. For a short time uncertainty prevailed, but ere long it became apparent that overseas commerce could still be conducted, although owing to the diversion of many passenger and merchant vessels, with some irregularity and at greater expense. By lowering the price of silver, which fell to 49 cents per ounce before the close of the year, the effect of the war was undoubtedly to lessen the activity of companies at Cobalt, some of whom preferred to allow their ore to remain in the mine rather than produce and market the metal at its reduced value. Nickel mining recovered from the shock caused by the outbreak of the war, and in November the Canadian Copper Company increased the number of their furnaces in blast to four; early in 1915 the whole six were again in operation, and the Company was preparing to build a seventh. The Mond Nickel Company, on the other hand, whose matte is exported to Wales for refining, having got their new works at Coniston into going order, pushed production to the utmost limits. On the whole, considering the tremendous nature of the conflict and the unprecedented disturbances in finance and commerce to which it has given and is still giving rise, it must be admitted that the mining industry of Ontario has stood the strain very well. The wonder is, not that the diminution in the output was so great, but that it was not much greater.

The following table summarizes the mineral output for the year, and gives in addition statistics showing the quantity of labour employed and wages paid out in the several branches:—

Table I.—Mineral Production of Ontario for 1914

Product.	Quantity.	Value.	Employees.	Wages.
Metallic:		$		$
Gold .... ounces	268,942	5,529,767	1,588	1,897,057
Silver .... "	25,217,994	12,795,214	3,331	3,208,239
Copper .... tons	14,453	2,081,332	3,464	3,131,520
Nickel .... "	22,760	5,109,088		
Iron ore .... "	240,059	531,379	623	286,904
Pig iron .... "	556,112	7,041,079	2,020	1,836,046
Cobalt ore .... "	97	27,743	(a)	(a)
Cobalt oxide .... lbs.	643,891	518,736	395	292,832
Nickel " .... "	303,752	27,716		
Cobalt and Nickel oxides .... "	113,843	45,189		
	....	33,707,243	11,421	10,652,598
Less Ontario Iron ore (163,779 tons) smelted into Pig iron....	....	361,952	....	....
Total metallic production	....	33,345,291	....	....
Non-metallic:				
Arsenic, refined .... lbs.	4,059,868	116,624	(b)	(b)
Brick, common .... No.	294,400,000	2,336,207	3,208	1,174,197
Tile, drain .... "	14,710,000	277,530		
Brick, paving, etc .... "	11,639,000	237,440	579	337,691
" pressed .... "	61,934,000	656 944		
Stone, building, etc	....	1,088,862	1,120	483,740
Calcium carbide .... tons	2,381	142,883	45	30,247
Cement, Portland .... bbls.	2,665,650	2,931,190	987	653,351
Corundum .... tons	548	65,730	69	43,383
Feldspar .... "	18,062	55,686	81	28,627
Graphite, refined .... "	1,363	87,167	78	31,609
Gypsum, crude .... "	43,183	58,800	144	93,400
" products .... "	31,117	162,375		
Iron pyrites .... "	107,258	264,722	216	167,901
Lime .... bush.	2,075,228	333,407	275	135,701
Mica .... tons	349	40,402	49	22,941
Natural gas .... million cu. ft.	14,063	2,346,687	479	256,139
Peat .... tons	600	2,100	25	1,500
Petroleum .... Imp. gals.	7,437,356	337,867	925	683,247
Phosphate of lime .... tons	450	3,150	....	....
Pottery	....	25,720	18	6,863
Quartz .... tons	52,947	82,544	81	34,385
Salt .... "	104,774	498,383	253	178,277
Sand and gravel .... cu. yds.	359,100	151,909	177	75,375
Talc, crude .... tons	1,269	3,807	35	28,207
" products .... "	8,866	70,776		
Sewer pipe	....	571,756	265	165,382
Total non-metallic production....	....	12,950,668	9,109	4,632,163
Add metallic	....	33,345,291	11,421	10,652,598
Total	....	46,295,959	20,530	15,284,761

(a) Included in Silver production. (b) Included in Oxide production.

In the year 1913 the mineral production of the Province was valued at $53,232,311, of which the metallic products contributed $37,507,935, and the non-metallic $15,724,376. Both divisions shared in the falling off in 1914, the metals losing $4,162,644, and the non-metals $2,773,708. The non-metallic production being smaller in value, the relative decrease under this heading is greater than in the metallic production, the percentages of diminution being 17.6 and 11 respectively. Of the aggregate value for 1914 $46,295,959, 72 per cent. is from the metallic substances, and 28 from the non-metallic, as compared with 70.5 per cent. and 29.5 per cent. respectively in 1913.

In Table II, which follows, comparison is made between the production of the various minerals and mineral substances in 1913 and 1914, showing the several increases and decreases.

Among the metals the following show gains: gold, $971,249, or 21.2 per cent.; copper, $240,840, or 13 per cent.; iron ore, $107,307, or 25.3 per cent., and cobalt, $126,093, or 29.9 per cent. These were more than offset by decreases in silver, $3,783,880 (22.8 per cent.); nickel, $128,389 (2.4 per cent.), and pig iron, $1,678,813 (19.2 per cent.).

The falling off was general in the non-metals, eighteen showing a loss and only seven an increase. The principal decreases were in building materials and clay products. All varieties of brick showed diminished output; common by no less an amount than $1,116,145 or 32.3 per cent., and pressed by $262,797 or 28.5 per cent. Portland cement fell off by $1,174,265 or 28.6 per cent., lime by $57,193 or 14.6 per cent., sand and gravel by $81,658 or 34.9 per cent. Petroleum was less by $60,184 or 15.1 per cent., feldspar by $11,456 or 17 per cent., talc by $50,757 or 40 per cent., and corundum by $71,306 or 52 per cent. Mica also lost $14,862 or 26.8 per cent., and quartz $48,316 or 36.9 per cent. It is quite evident from these figures that a considerable number of the smaller branches of the mining industry felt severely the pressure of the unusual circumstances of the past year.

On the other hand, the following substances recorded gains: arsenic, $52,478, or 81.8 per cent.; iron pyrites, $93,035, or 54.1 per cent., and salt, $24,011, or 5 per cent. There was also a decided increase in gypsum and its products.

Table II.—Comparative Value, Mineral Production, 1913 and 1914

Product.	1913	1914	(I) Increase. (D) Decrease.	
Metallic:	$	$		$
Gold	4,558,518	5,529,767	I	971,249
Silver	16,579,094	12,795,214	D	3,783,880
Copper	1,840,492	2,081,332	I	240,840
Nickel	5,237,477	5,109,088	D	128,389
Iron ore	424,072	531,379	I	107,307
Pig iron	8,719,892	7,041,079	D	1,678,813
Cobalt ore and oxide	420,386	546,479	I	126,093
Nickel oxide	13,326	27,716	I	14,390
Non-metallic:				
Arsenic	64,146	116,624	I	52,478
Brick, common	3,452,352	2,336,207	D	1,116,145
" pressed	919,741	656,944	D	262,797
" paving, fancy, etc	243,119	237,440	D	5,679
Stone, building and crushed	1,137,153	1,088,862	D	48,291
Calcium carbide	123,100	142,883	I	19,783
Cement, Portland	4,105,455	2,931,190	D	1,174,265
Corundum	137,036	65,730	D	71,306
Feldspar	67,142	55,686	D	11,456
Graphite	93,054	87,167	D	5,887
Gypsum	92,627	221,175	I	128,548
Iron pyrites	171,687	264,722	I	93,035
Lime	390,600	333,407	D	57,193
Mica	55,264	40,402	D	14,862
Natural gas	2,362,021	2,346,687	D	15,334
Peat	1,750	2,100	I	350
Petroleum	398,051	337,867	D	60,184
Phosphate of lime		3,150	I	3,150
Pottery	52,875	25,720	D	27,155
Quartz	130,860	82,544	D	48,316
Salt	474,372	498,383	I	24,011
Sand and gravel	233,567	151,909	D	81,658
Sewer pipe	600,297	571,756	D	28,541
Talc	125,340	74,583	D	50,757
Tile, drain	292,767	277,536	D	15,231

In Table III is given the mineral production of the Province for the five years ending with 1914, enabling a bird's-eye view to be had of the progress of the mining industry during that time in its various branches. The rapid development is noticeable which characterizes the Table as a whole, notwithstanding the set-back recorded in the figures for 1914; in several of the products there is comparatively little change from year to year, while in one or two cases, it is evident that failing new sources of supply, the diminishing returns will continue to grow less.

Table III.—Mineral Production, 1910 to 1914

Product.	1910	1911	1912	1913	1914
Metallic:	$	$	$	$	$
Gold	68,498	42,637	2,114,086	4,558,518	5,529,767
Silver	15,481,322	15,953,895	17,671,918	16,579,094	12,795,214
Cobalt	54,699	170,890	315,781	420,386	(a) 546,479
Copper	1,374,103	1,281,118	1,584,310	1,840,492	2,081,332
Nickel	4,005,961	3,664,474	4,736,460	5,250,803	(b) 5,136,804
Iron ore	513,721	445,930	238,884	424,072	531,379
Pig iron	6,975,418	7,716,314	8,054,369	8,719,892	7,041,079
Cobalt and Nickel oxides (not separated)	....	....	....	....	45,189
Zinc ore	5,760	....	....	....	....
Lead	....	....	1,290	....	....
Platinum	....	....	80,736	....	....
Palladium	....	....	147,235	....	....
	28,479,482	29,275,258	34,945,069	37,793,257	33,707,243
Less value Ontario iron ore smelted into pig iron	317,804	172,391	145,326	285,322	361,952
Net metallic production	28,161,678	29,102,867	34,799,743	37,507,935	33,345,291
Non-metallic:					
Actinolite	320	....	....	....	....
Arsenic	70,709	74,609	79,297	64,146	116,624
Brick, common	2,374,287	2,801,971	3,178,250	3,452,352	2,336,207
" paving	70,648	86,685	221,986	243,119	237,440
" pressed	458,596	564,630	634,169	919,741	656,944
Building and crushed stone	761,126	892,627	953,839	1,137,153	1,088,862
Calcium carbide	184,323	84,437	120,000	123,100	142,883
Cement, Portland	3,144,343	3,640,642	3,365,659	4,105,455	2,931,190
Corundum	171,994	147,158	233,212	137,036	65,730
Feldspar	47,518	51,610	28,916	67,142	55,686
Fluorspar	15	200	....	....	....
Graphite	55,637	36,492	65,076	93,054	87,167
Gypsum	17,825	32,535	50,246	92,627	(c) 221,175
Iron pyrites	98,353	118,457	71,043	171,687	264,722
Lime	474,531	402,340	381,672	390,600	333,407
Mica	85,294	43,058	57,384	55,264	40,402
Natural gas	1,491,239	2,186,762	2,268,022	2,362,021	2,346,687
Peat fuel	1,284	2,830	725	1,750	2,100
Petroleum	368,153	353,573	344,537	398,051	337,867
Phosphate of lime	....	240	....	....	3,150
Pottery	51,485	50,500	52,445	52,875	25,720
Quartz	87,424	64,405	179,576	130,860	82,544
Sand and gravel	....	....	....	233,567	151,909
Salt	414,978	430,835	450,251	474,372	498,383
Sewer pipe	357,087	410,064	464,627	600,297	(d) 571,756
Talc	46,592	47,725	61,358	125,340	74,583
Tile, drain	318,456	349,545	279,579	292,767	277,530
Total non-metallic production	11,152,217	12,873,930	13,541,869	15,724,376	12,950,668
Add metallic production	28,161,678	29,102,867	34,799,743	37,507,935	33,345,291
Total production	39,313,895	41,976,797	48,341,612	53,232,311	46,295,959

(a) Cobalt oxide and Cobalt ore. (b) Includes Nickel oxide.
(c) Crude Gypsum and Gypsum products. (d) Crude and Ground Talc.

The entire production of metals in Ontario from the beginning of mining to the end of 1914 is shown by the figures given below. The total value is upwards of 297 millions of dollars. Making allowance for that part of the iron ore product which was smelted into pig iron in the Province, the aggregate value can safely be placed at 293 millions of dollars. Accurate figures of production for the early years of iron and copper mining are not now obtainable, but as much the greater part of the output has been made since the systematic collection of statistics began in 1891, any error due to this cause is negligible.

Table IV.—Total Production of Metals in Ontario

Metal.	Value.
	$
Gold	14,822,998
Silver	126,550,597
Platinum and Palladium	290,755
Cobalt	2,039,006
Nickel	51,400,370
Copper	21,161,355
Iron ore	7,679,836
Pig iron	73,007,672
Lead	117,290
Zinc	92,410

Water Powers

Situated as all the principal mining camps of Ontario are, in rocky areas well supplied with rivers and lakes, they are able to take advantage of cheaply developed water power within convenient distance for transmission to mines and works. The harnessing of water powers for mining and other industrial purposes has gone on with much rapidity in northern Ontario. The silver mines and mills of Cobalt are operated by electric energy derived from falls on the Montreal and Matabitchuan rivers; power for Gowganda is developed on the Montreal, and further utilization of that stream is now being undertaken; the Mattagami river at Wawaitin and Sandy falls furnishes current for operating the mines and stamp mills at Porcupine; energy is transmitted from the Blanche river at Charlton to the Tough-Oakes mine at Kirkland Lake, and a power in Marter township on another branch of the same stream is about to be developed to supply further requirements of the camp; Iroquois, Twin and Couchiching falls on the Abitibi are now operating the machinery of the Abitibi Pulp and Paper Company; and the Sturgeon at Sturgeon Falls, the Spanish at Espanola, the St. Mary at Sault Ste. Marie, the Wabigoon at Dryden, the Rainy at Fort Frances, perform a similar office for the pulp and paper plants at these places. In the Sudbury region, the Canadian Copper Company obtain their power from the Spanish river at Turbine and have large projects for further developments on that river; and the Mond Nickel Company draw upon the energy developed by falls on the Wanapitei in Dryden and Secord townships, on the Vermilion at Wabigeshek, and the Spanish at Nairn. The Michipicoten at High, and the Magpie at Steep Hill, falls supply power to the iron mines of that district. The Winnipeg river where it leaves Lake of the Woods is utilized in grinding wheat on a large scale at Keewatin and for municipal and industrial purposes at Kenora, and the tumbling rapids of the St. Mary where it empties out of lake Superior suffice for a variety of industries at Sault Ste. Marie. In eastern Ontario, water power from the Trent operates the silver refinery at Deloro, from Deer lake the gold mine at Cordova, and from the Madawaska the graphite mine and mill at Whitefish lake. At Ottawa and Gananoque, Peterborough and many other places, water power on a considerable scale has long been in use for operating machinery, providing light, etc. It is unnecessary to mention the falls of Niagara and

the vast scheme for distributing throughout southwestern Ontario the benefits of cheap power so successfully carried out by the Hydro-Electric Commission of Ontario; or the developments at De Cew falls, or on the Grand, Saugeen, Severn and numerous other streams in the older parts of the Province, since the uses to which the power is applied belong more to manufacturing and agriculture than to the mining industry. In probably every case, the cost of power has been reduced by at least 50 per cent. of its expense when derived from burning wood or coal, and the development has been a boon indeed to mining in this Province.

But water power has its disadvantages as well as its advantages. Chief of these is the liability to serious diminution because of insufficient rainfall. The annual precipitation of moisture in southern Ontario is about 32 inches, but is considerably less in the northern parts of the Province, varying according to district. In some years of course the precipitation is much heavier, and in some much smaller. The excess is simply allowed to run off, and so is of no significance to the user of water power; but there is no way to supply a deficiency. Ample storage capacity assists to equalize the flow, but reservoirs cannot create water, or hold it unless it flows into them. The season of 1914 was unusually dry, and in consequence during the low water period, which occurs in January, February and March, the water powers upon which the mines and plants of Cobalt, Porcupine, Sudbury and elsewhere depend were unequal to the occasion. The situation in the early part of 1914 was much the same, but the beginning of 1915 faced an accumulated deficit, and a system of shutting down mills and works in rotation had to be put into effect. The result was of course to lessen production, to what extent the statistics for the output of 1915 will no doubt reveal. It would seem that the effect is likely to be prolonged into the year, for the light snowfall of winter disappeared with few or no accompanying rains, and the present prospect is not promising for a good supply of power in 1915. One result will be that resort will be had to auxiliary steam plants, and where they have been retained, their aid will undoubtedly be welcomed. In making provision for the operation of machinery, prudence counsels a reserve of motive power. Thus, in constructing a central compressed air plant at the Hollinger gold mine to serve present and future requirements, sufficient boiler capacity was installed for use in case of failure of the supply of electricity developed from water-power. The style of compresser selected had the advantage of being reversible; that is, the machines may be used as steam engines, and their motors for generating electrical power.

By an amendment to the Rivers and Streams Act the Legislature last session considerably modified the law regarding the use of rivers for the dual purpose of floating sawlogs and generating power. Formerly, the lumberman was practically in full control, the statute granting him the right to use the river at freshet seasons for driving his logs to market. So long as there was no other use for the water, no harm was done, but as shown above the development of water power on the streams of eastern, northern and northwestern Ontario during the last few years has been very rapid. The power user naturally wished to conserve as much of the freshet flows as possible, so that his turbines might continue to turn during the inevitable season of low water. If compelled to shut down, mines, pulp mills and other industries depending upon him for power were obliged to follow suit.

Both lumbering and water-power development are important, and the situation required regulation. What the Legislature did was in effect to place authority in the Minister of Lands, Forests and Mines to deal with emergencies as they arose, and to exercise control over the levels of any stream where conflicting interests required action to be taken. The amendments will be found in 5 Geo. V, chapter 15 (Rivers and Streams Act, 1915.)

The rentals paid to the Crown under water power leases for the last fiscal year were $21,126.82.

Legislation Affecting the Mining Industry

On 1 January, 1914, the law came into force prohibiting underground labour in mines for more than eight hours out of the twenty-four. The law does not apply to territory having county organization, and under a special provision of the Act iron mines conforming to a high standard of safety were declared exempt. Little or no opposition has been manifested to the Act, largely no doubt because of similar laws obtaining in those parts of the continent from which the bulk of miners in Ontario come, as well as in the coal mines of Great Britain, and it is now a recognized part of mining routine.

A year later, 1 January, 1915, the Workmen's Compensation Act took effect. The Act covers all other industrial operations in the Province as well as mining. Necessarily the first year's experience with the measure will be more or less tentative, but the machinery provided for its administration will enable satisfactory adjustments to be made. One good result will follow; the relations between capital and labour will no longer be disturbed by a system under which the employer was often made the unwilling instrument in denying compensation when an employee was killed or injured, and which frequently led to the still further impoverishment of the victim or his beneficiary by ill-advised and expensive litigation. The chairman of the Workmen's Compensation Board is Mr. Samuel Price, K.C., who served for a number of years with much satisfaction to the mining community as Mining Commissioner.

A few changes were made in the Mining Act of Ontario at the session of 1915. The principal amendment was one providing for the protection of mining claims held by men enlisting for service against the King's enemies at home or abroad. Such claims are exempted from forfeiture for any of the statutory causes until 1 January, 1916, at which time the period of exemption may be extended by the Lieutenant-Governor in Council.

In view of the disturbance of economic conditions consequent upon the war, Orders-in-Council were passed in August and October, 1914, providing a general extension of time for performing assessment work on all mining claims to 15 April, 1915. The actual extension in many cases is beyond this date, depending upon the date of recording the claim.

Gold

For the first time, Ontario in 1914 took the lead in gold mining among the Provinces of Canada, her output exceeding that of either Yukon Territory or British Columbia. The yield in Ontario was 268,942 ounces, worth $5,529,767; in the Yukon the value was $5,125,396, and in British Columbia $5,177,343.

In Ontario, gold means Porcupine, just as silver means Cobalt, and nickel Sudbury. The preponderance of Porcupine is shown by the fact that the mines of this camp produced gold to the value of $5,190,794, as against a production from other parts of the Province of $338,973. The producing mines were twelve in number, as follows:—In Porcupine: Hollinger, Acme, Dome, McIntyre-Porcupine, Porcupine-Crown, Vipond, Mines Leasing Company, Porcupine Pet; at Kirkland Lake, Tough-Oakes; at Long Lake, Canadian Exploration Company; at Larder Lake, La Mine D'Or Huronia; in Peterborough county, Cordova.

The quantity of ore milled in the Porcupine mines was 558,084 tons, which yielded a value of $5,190,794, or $9.30 per ton. At the remaining mines 338,973 tons of ore were treated, from which was obtained $338,973, or $6.76 per ton. From the bullion produced at the gold mines 55,153 fine ounces of silver were recovered, worth $29,753.

The employees numbered 1,588, of whom 811 worked underground, and 777 on the surface. They were paid in wages during the year $1,897,057.

In crushing the ore, a total of 225 stamps was employed; two of the mills do not use stamps, crushing by rolls and ball mills instead.

Following are the statistics of gold mining in 1914:—

Mines worked	No.	12
Ore treated	tons	608,200
Gold product	oz.	268,942
Value of gold product		$5,529,767
Silver product	oz.	55,153
Value of silver product		$29,753
Men above ground	No.	777
Men below ground	No.	811
Wages paid		$1,897,057

In the following list are given the names and addresses of the gold mining companies reporting to the Bureau of Mines for the year 1915, with other particulars, discriminating between those which produced bullion during the year and those which were non-productive:—

Gold Mining Companies, 1914

Name of Company.	Name of Mine.	Locality.	No. of Stamps.	P. O. Address of Manager, etc.
*Acme Gold Mines, Limited	Acme	Porcupine	....	Timmins.
Canadian Exploration Co., Limited	Long Lake	Long Lake	20	Naughton.
Cordova Mines, Limited	Cordova	Peterboro'	30	Cordova Mines.
Dome Mines Company, Limited	Dome	Porcupine	80	South Porcupine.
Hollinger Gold Mines, Limited	Hollinger	"	60	Timmins.
†McIntyre-Porcupine Mines, Limited	McIntyre-Porcupine	"	....	Schumacher.
Mines Leasing and Developing Co., Limited	Rea	"	10	"
Porcupine Crown Mines, Limited	Porcupine Crown	"	20	Timmins.
‡Porcupine Vipond Mines, Limited	Vipond	"	....	Schumacher.
Tough-Oakes Gold Mines Limited	Tough-Oakes	Kirkland Lake.	5	Kirkland Lake.
Non-Producing Companies:				
Gilmour Mining Co., Limited	Gilmour	Hastings Co.	5	Gilmour.
Jupiter Mines, Limited	Jupiter	Porcupine	....	Schumacher.
Lake Shore Mining Co., Limited	....	Kirkland Lake.	....	Kirkland Lake.
Olympia Gold Mining Co., Limited	Olympia	Shoal Lake	10	973 Hague Avenue, St. Paul, Minn.
Teck-Hughes Gold Mines, Limited	Teck-Hughes	Kirkland Lake.	....	Kirkland Lake.

Gold at Big Duck Lake

A discovery of gold having been reported from Big Duck lake, north of Schreiber station on the Canadian Pacific railway, Mr. Percy E. Hopkins of the Bureau of Mines geological staff was sent to investigate and report. Mr. Hopkins' report is as follows:—

Late in October, 1914, the writer was instructed by the Provincial Geologist to proceed to Schreiber and make a preliminary examination of the gold discoveries north of that place. As shown on the accompanying sketch map, scale two miles to the inch, the gold deposits lie in the vicinity of Big Duck lake, which is about 13 miles north of Schreiber, a divisional point on the transcontinental line of the Canadian Pacific railway, in the Port Arthur mining division.

Big Duck lake can be reached by a comparatively easy canoe route from Schreiber in about nine hours via a chain of small lakes and ponds connected by streams and collectively known as the Big Duck creek, which empties by way of the Black[1] river into lake Superior about seven miles east of Schreiber. There are 15 portages in all, with a total length of six and one-half miles.

This lake is near the headwaters of the Big Duck creek, and has an elevation of 1,495 feet (aneroid) above sea level, being thus about 500 feet higher than Schreiber.

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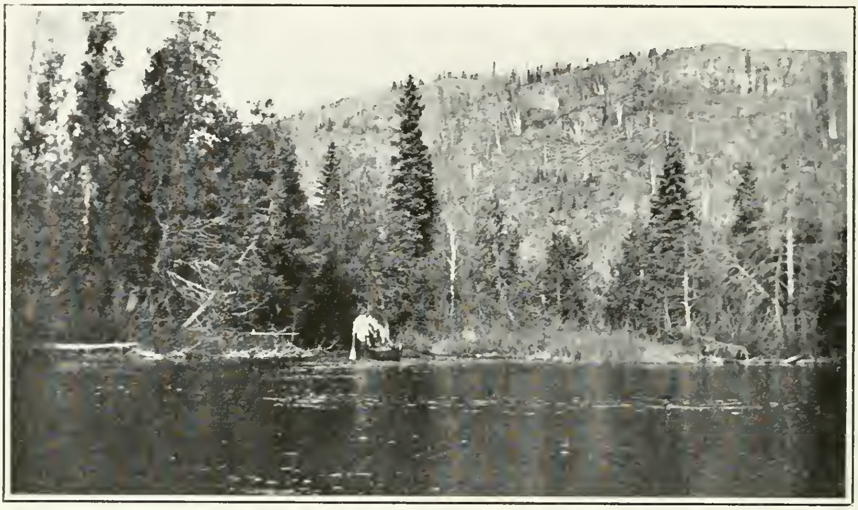
* Ore treated in Hollinger mill.

† 1-36 in. x 16 in. rolls, and 2-6 ft. x 16 in. Hardinge Ball Mills, with 2-5 ft. tube mills.

‡ 2-4½ ft. Hardinge ball mills.

[1]As there are several rivers in Ontario to which the name Black is applied, it would seem that some of them should be renamed.

The country consists of large hills which rise abruptly 200 to 500 feet above the lakes and rivers. Going north from Schreiber one passes over about seven miles of Keewatin greenstones, which are well exposed, as the timber is almost completely burned off. Then come eight miles of pre-Cambrian granites and gneisses which continue to within a mile of Big Duck lake. Around Big Duck lake is an area of massive and schistose hornblende rocks, which are cut by quartz-porphyry dikes and contain gold-bearing veins. North of this belt lie hornblende, garnet and biotite gneisses cut by pegmatite dikes.



Looking up Big Duck Creek, 2 miles south of Maude lake, Keewatin hill about 200 feet high

Outlet of Big Duck lake, fall about 75 feet

W. H. Collins in 1905 passed through Big Duck lake during his exploration of the area for the Geological Survey of Canada.[2] His guide, Fisher, was reported to have returned the following year to his hunting grounds and staked two claims with gold showings near Big Duck lake. These were sold to T. Kemp Barnard, now deceased. Fisher afterwards restaked the claims, and sold one to McCuaig of Schreiber in 1913 and the other to Sjolander and McKirdy of Nipigon in January, 1914. Gold specimens obtained from these claims resulted in some staking in 1913, and more in 1914. About 250 claims have been staked to the end of 1914.

Following is a list of some of the principal claim-owners:—D. McCuaig, M. McKirdy, J. O. Burstrom, Carl Sjolander, L. H. Estell, B. Madson, August Estell, Henry Larsom, Albert Fisher, John McGugan and J. A. Johnson.

The rocks of Big Duck lake consist principally of hornblende and biotite schists, striking about east and west and dipping from vertical to 60° to the north. A thin section from the McCuaig claim (T.B. 1686) shows the rock to consist of about 60 per cent. of hornblende partly altered to chlorite and partly replaced by quartz in a fine crystalline groundmass of quartz, sericite, calcite or dolomite, kaolin and epidote, with much magnetite and pyrite. Some dark green massive rocks, diabasic in texture, occur also, all presumably of Keewatin age.

These rocks are cut by numerous light grey quartz-porphyry dikes and stock-like masses which show prominent quartz phenocrysts. Some are massive, while others are quite schistose. The dikes occur up to 30 chains in width and run in an east and west direction. The quartz-porphyry intrusions extend over an area two miles from north to south. The most westerly outcrop seen is on the west shore of Little Duck

Big Duck Lake, looking up the northeast arm.

lake. A thin section shows large rounded phenocrysts of quartz, some hexagonal in outline and occasional microline or biotite phenocrysts set in micro-crystalline groundmass of quartz, carbonate, chlorite, leucoxene, epidote and hornblende, with some pyrite. The minute feldspars in the groundmass are all altered to sericite and other materials. A narrow quartz-diabase dike was seen cutting the quartz-porphyry on the Burstrom claim, one-half mile south of the surveyed claim, T.B. 1374.

The gold-bearing quartz veins occur in the hornblende schist near the quartz-porphyry intrusive, at the contact of the two rocks and in the quartz-porphyry itself. The veins consist of granular quartz and carbonates, together with some schist, and are cut by secondary veinlets of quartz. Much pyrite, chalcopyrite, and some pyrrhotite, galena, zinc blende, magnetite and molybdenite (?) are disseminated through the veins. The width of the veins in places is 25 feet. The veins appear to have in part replaced the country rock. Their strikes approximate an east and west direction. From the assays it appears that little gold is present in the veins unless it can be seen.

Only two veins with visible gold were seen in the area; the following is a description of them:—

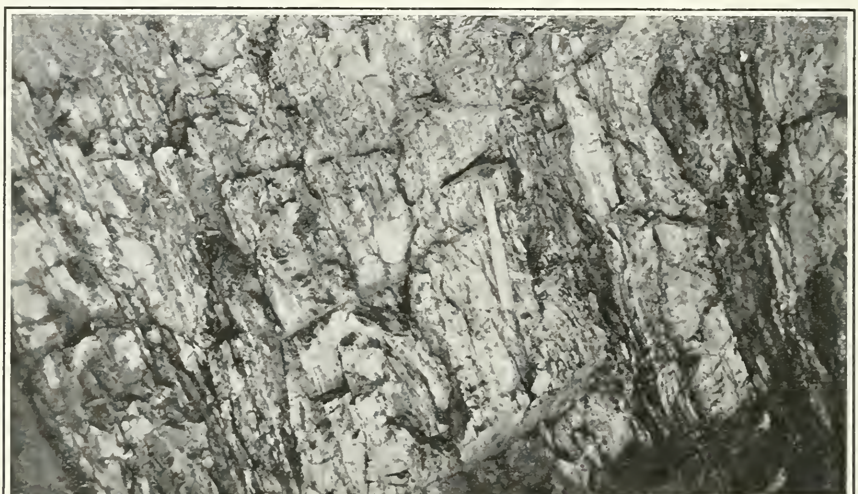
McCuaig Claim.—On claim T.B. 1686 (directly east of the surveyed claim T.B. 1309, which is shown on the map) is a quartz vein striking S. 80° W. and dipping 70° to the north. The vein outcrops in a creek bed in a dike of quartz-porphyry schist, which is 125 feet wide and intrudes the hornblende schist. A six-foot pit sunk on the vein exposes 40 inches of quartz mineralized with pyrite, coarse zinc blende and fine galena. Considerable gold in a fine flour state can be seen across 10 inches along the bottom and sides of the pit. The vein was not uncovered lengthwise. During the past winter Mr. C. Sjolander of Nipigon sorted out and shipped 2,710 pounds of ore from this vein to the Balbach Smelting and Refining Company, Newark. The returns showed the ore to contain moisture, 10 per cent., silver per ton 3.90 ounces, and gold 2.00 ounces; total

[2] Geol. Sur. Canada. Report on Region between Pic and Nipigon rivers, Ont., 1909.

value $43.00 per ton. When the writer visited the property in May, 1915, the water and fallen-in wall rock covered the vein. It was reported, however, that the vein is from three and one-half to four feet wide, and contains considerable gold in a state of fine division along the entire length of the 40-foot open cut. The vein outcrops in the creek bed 200 feet west of the open cut. Gold can be panned from the sands in the creek bed.

Sjolander-McKirdy Claims.—About one mile east of the McCuaig is the Sjolander-McKirdy vein (claims T.B. 1861 and 1955), which occurs in the hornblende schist about 400 feet north of a quartz-porphyry dike. The two unsurveyed claims lie east of the surveyed claim T.B. 1374 shown on the map. The vein strikes S. 70° W. and dips 75° to the north, and coincides with the dip and strike of the country rock. The vein where exposed is 24 feet wide, with an open cut eight feet deep across its entire width. Considerable gold in a state of fine division occurs about five feet from the hanging wall. Much pyrite, with some galena, zinc blende and chalcopyrite, is disseminated through the quartz-carbonate-schist vein. The assays indicate an ore-shoot six or seven feet wide near the hanging wall. A thin section of the ore shows interlocking quartz and carbonate grains with gold and pyrite closely associated lying between the grains. During the past winter 500 pounds of this vein matter was shipped to a smelter.

From Little Duck lake to the east end of Big Duck lake are a number of veins of somewhat similar character with similar strike, etc.; 15- and 20-foot pits have been sunk on some of them.



Vertical face of gold vein, Sjolander claim, T.B., 1955

Burstrom Claim.—The Burstrom claim, T.B. 2091, lies two claims south of the surveyed claim T.B. 1374. A large quartz-schist deposit, containing chalcopyrite, pyrite, and other minerals runs easterly across this claim. A channeled sample across 22 feet of the deposit gave two per cent. of copper and 20 cents in gold. During the winter a 25-foot shaft has been sunk on this vein showing considerable pyrite and chalcopyrite in a quartz gangue.

Coco-Estelle Claim.—The Coco-Estelle claim, T.B. 2093, lies immediately south of the McCuaig claim, and is tied to the southeast corner of the surveyed claim T.B. 1309. On a high part of the claim is a rusty quartz vein about six feet in width which carries pyrite and chalcopyrite and runs east and west. No gold was seen in the vein, but samples taken for assay from the bottom of the 10-foot pit indicated the presence of considerable gold.

Johnson-Fisher Claim, T.B. 2106.—This unsurveyed claim lies on the southwest shore of Little Duck lake. A five-foot pit is sunk on a quartz vein five feet in width, which strikes east and west and dips 60° to the north in a hornblende schist. A sample across five feet gave $7.60 in gold to the ton.

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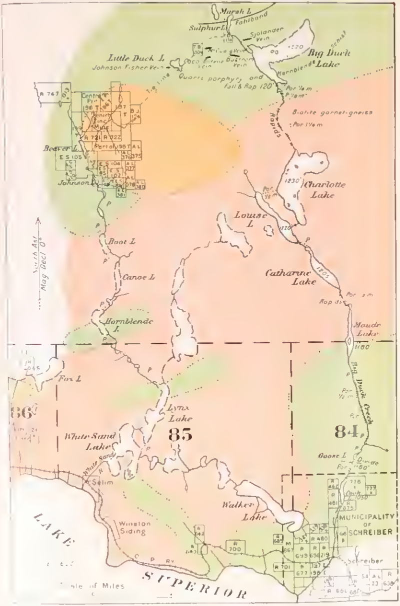
Map No. 24b

GEOLOGY AND CANOE ROUTES
FROM
Schreiber to Big Duck Lake

To accompany Report by P. F. Hopkins, in Part I, Vol. 24, Report of Ontario Bureau of Mines, 1915

Hon. G. H. Ferguson, *Minister* Willet G. Miller, *Provincial Geologist*



LEGEND

INTRUSIVE

Diorite

LAURENTIAN

Granite and biotite-garnet gneiss

KEEWATIN

Hornblende schist, greenstone, quartzite, quartz-porphyry, etc.

SOURCES OF INFORMATION

Base map and surveyed mining locations from plans by Surveys Branch, Department of Lands, Forests and Mines, Ontario.

Map No. 964, Geological Survey of Canada, 1909.

Geology, track survey and aneroid elevations from Schreiber to Big Duck Lake by P. E. Hopkins, 1914.

Assays of samples from other claims gave 40 cents, 60 cents and $2.50 in gold to the ton, while five samples gave no gold. None of the samples taken contained any silver.

Running northeastward across Sulphur lake is a narrow falhband two miles or more in length. Pyrite veins up to two feet in width and carrying low gold values were noticed, but they are too small to mine for sulphur. Pyrrhotite veins up to three feet in width also occur in the falhband.

On claim T.B. 746 on the north shore of Little Duck lake Mr. C. Sjolander reports a vein 12 to 14 feet wide. The samples sent to me consisted of pyrrhotite with disseminated streaks of zinc blende. The samples were found to contain 8.55 per cent. of zinc and nothing in gold.

This claim lies about two and one-half miles northeast of the old Zenith zinc mine, which is under option at present. The Zenith mine[3] was operated during the years 1899-1901. During that time upwards of 1,500 tons of zinc ore were mined and shipped over a 13-mile winter road, via the White Sand river route, to Lake Superior. This road might very easily be repaired and extended four miles farther to Big Duck lake. Over 500 tons of zinc ore still remain on the dump.

Part of the Zenith mine workings, showing where numerous zinc blende pockets have been worked from the hill side

Much of the forest had been completely burned from Schreiber for seven miles. North of this, small spruce, birch and poplar are the prevailing trees, some attaining a diameter of 18 inches. This timber would be suitable for mine purposes, ties or pulpwood. A few cedar and tamarac occur in places along the water's edge. The outlet of Big Duck lake drops over a fall of about 75 feet, which would not develop much over 50 or 100 horsepower, owing to the small volume of water.

In concluding, it may be said that the veins are numerous, fairly large and well mineralized. Besides gold the prospector should be on the lookout for copper, zinc, pyrite and other minerals. Further systematic prospecting and development work may bring to light richer ore bodies. The quartz-porphyry resembles very much the quartz-porphyry at Porcupine.

The writer wishes to express his thanks to many of the prospectors for assistance in various ways. The assays were made by Messrs. W. K. McNeill and T. E. Rothwell of the Provincial Assay Office.

[3]Ont. Bureau of Mines. Vols. IX, X and XI.

Silver

The output of silver in 1914 was 25,217,994 fine ounces, being a decrease, as compared with the production of 1913, of 4,506,937 ounces, or 15 per cent.

The record year for the silver mining industry was 1911, when the mines yielded 31,507,791 ounces. Every year since then there has been a diminution in the output as compared with the year preceding; it would seem that unless unexpected accessions are made to the productive veins or areas, the decline will continue.

Apportioning the production to the several sources, we have the following:—

	Ounces.
Cobalt proper	24,155,699
Casey township	499,643
South Lorrain	108,199
Gowganda	399,300
Gold mines	55,153
Total	25,217,994

The producing mines numbered 32, as against 35 in 1913.

It has been customary to mention in this Report the mines whose production amounted to one million ounces or more. The list for 1914 is as follows:—

	Ounces.
Nipissing	3,999,863
Mining Corporation of Canada (City of Cobalt and Cobalt Townsite)	3,079,275
Coniagas	2,459,007
Kerr Lake	1,817,087
Crown Reserve	1,425,320
Seneca-Superior	1,409,766
La Rose	1,398,404
McKinley-Darragh-Savage	1,260,046
Mining Corporation of Canada (Cobalt Lake)	1,247,677
O'Brien	1,237,345

The new name on the list is Cobalt Lake, which replaces Buffalo; but the order varies considerably from that of 1914. Nipissing remains at the head, where it has been since mining at Cobalt began. Cobalt Townsite and City of Cobalt, now united under the management of the Mining Corporation of Canada—which company also operates Cobalt Lake mine—occupy second place, Coniagas being third instead of second as in 1913.

Five mines produced more than half a million, but less than a million ounces each, as follows:—

	Ounces.
Buffalo	912,350
Cobalt Comet	712,892
Beaver Consolidated	692,095
Penn-Canadian	556,119
Trethewey	543,097

The remaining mines yielding silver in 1914 were as follows in alphabetical order:—Aladdin Cobalt, Bailey Cobalt, Cart Lake, Chambers-Ferland, Cochrane, Drummond Fraction, Foster, Hudson Bay, Keeley, Peterson Lake, Right of Way, Temiskaming, Casey Cobalt, Wettlaufer-Lorrain, Mann, Miller-Lake O'Brien. Of these Keeley and Wettlaufer-Lorrain are in South Lorrain, Mann and Miller-Lake O'Brien in Gowganda, and Casey Cobalt in Casey township. The rest are in Cobalt proper.

Shipments

The development of concentrating and refining processes which has been so marked a feature in the Cobalt camp has much diminished the quantity of ore shipped out as such; in fact, including the effect of the refining works at other points in Ontario, it it may almost be said that so far as refining is concerned, the silver industry has reached a self-contained position within the limits of the Province. In 1908 the quantity of ore shipped out was 21,487 tons; and in that year the first concentrates were produced and shipped, the consignments amounting to 1,137 tons. Five years later, in 1913, the ore shipments had fallen to 9,861 tons, and the concentrates had risen to 11,016 tons. In 1914 the quantity of ore sold as such was only 5,267 tons, of which 965 tons were purchased by the Nipissing Mining Company and reduced to bullion at that company's plant, making the ore actually shipped out of the camp 4,302 tons. This, with the exception of about 1,400 tons, was of high-grade quality, containing on an average 2,168 ounces of silver per ton.

The concentrates shipped away during the last three years have remained at a nearly stationary figure; being in 1912 11,214 tons, in 1913 11,016 tons and in 1914 12,152 tons.

On the other hand, the silver sent out as bullion has increased very rapidly since the first shipments were made in 1910. In that year 980,633 ounces were sent out as bullion; in 1914 this had grown to 9,742,130 ounces. In part this was the product of ore bought by the Nipissing Company from other mines, the total shipments of bullion by that company amounting to 6,335,697 fine ounces. The remainder was produced by the Nipissing Company from its own ores, both high and low grade, by the Buffalo and O'Brien mines and the Dominion Reduction Company; a little also from nuggets and metallics was smelted at the Crown Reserve mine and the sampling works of Messrs. Campbell and Deyell. Adding to the bullion sent out by the camp itself, the product of the refining works at Thorold, Deloro and Orillia, a total is obtained of 19,051,677 fine ounces, or 75.5 per cent. of the total production of silver for the year.

The silver therefore despatched from Cobalt during the year was contained in the several classes of material as follows:—

	Tons.	Ounces.
Ore	4,302	6,504,753
Concentrates	12,152	8,915,958
Bullion	.....	9,742,130
Total		25,162,841

Statistics of the yearly and total output of silver from the mines of Cobalt since their opening in 1904 are given in Table V, which follows:—

Table V.—Silver Production, Cobalt Mines, 1904 to 1914

Year.	Producing Mines.	Shipments.			Silver Contents.			Av'ge Silver Contents per Ton.		Value of Silver Shipments.			Total.	
		Ore.	Concentrates	Bullion.	Ore.	Concentrates.	Bullion.	Ore.	Concentrates.	Ore.	Concentrates.	Bullion.	Ounces.	Value
	No.	Tons.	Tons.	oz.	oz.	oz.	oz.	oz.	oz.	$	$	$		$
1904	4	158	.....	.....	206,875	.....	.....	1,309	.....	111,887	.....	.....	206,875	111,
1905	16	2,144	.....	.....	2,451,356	.....	.....	1,143	.....	1,360,503	.....	.....	2,451,356	1,360,
1906	17	5,335	.....	.....	5,401,766	.....	.....	1,013	.....	3,667,551	.....	.....	5,401,766	3,667,
1907	28	14,788	.....	.....	10,023,311	.....	.....	677	.....	6,155,391	.....	.....	10,023,311	6,155,
1908	30	24,487	1,137	.....	18,022,480	1,415,395	.....	736	1,244	8,468,293	665,085	.....	19,437,875	9,133,
1909	31	27,729	2,948	.....	22,436,355	3,461,470	.....	809	1,174	10,809,872	1,651,704	.....	25,897,825	12,461,
1910	41	27,437	6,845	980,633	22,581,714	7,082,834	980,633	821	1,030	11,360,489	3,590,098	527,460	30,645,181	15,478
1911	34	17,278	9,375	3,132,976	20,318,626	8,056,189	3,132,976	1,176	858	10,250,991	4,017,241	1,685,615	31,507,791	15,953
1912	30	10,719	11,214	5,080,127	15,395,504	9,768,228	5,080,127	1,436	871	8,766,871	5,556,919	3,085,145	30,243,859	17,408
1913	35	9,861	11,016	7,524,575	13,668,079	8,489,321	7,524,575	1,386	770	7,444,995	4,554,797	4,554,189	29,681,975	16,553
1914	32	4,302	12,152	9,742,130	6,504,753	8,915,958	9,742,130	1,511	733	3,314,462	4,377,897	5,073,102	25,162,841	12,765
Tl..	..	144,238	54,687	26,460,441	137,010,819	47,189,395	26,460,441	950	862	71,711,305	24,413,741	14,925,511	210,660,655	111,05

Silver Mining Companies, 1914

Name of Company or Owner.	Name of Mine.	Locality.	P. O. Address of Manager, etc.
Aladdin Cobalt Company, Limited	Silver Queen	Cobalt	Cobalt
Associated Gold Mines of Western Australia Limited, The	Keeley	South-Lorrain Tp.	Silver Centre.
Bailey Cobalt Mines, Limited	Bailey	Cobalt	Giroux Lake.
Beaver Consolidated Mines, Limited	Beaver	Cobalt	Cobalt.
Buffalo Mines, Limited, The	Buffalo	Cobalt	Cobalt.
Cart Lake Cobalt-Silver Mines Limited	Peterson Lake	Cobalt	Cobalt.
Casey Cobalt Silver Mining Company, Limited	Casey-Cobalt	Casey Township	New Liskeard.
Chambers-Ferland Mining Company, Limited	Chambers-Ferland	Cobalt	Cobalt.
*City of Cobalt Mining Company, Limited	City of Cobalt	Cobalt	Cobalt.
*Cobalt Townsite Mining Company, Limited	Cobalt Townsite	Cobalt	Cobalt.
Cobalt Comet Mines, Limited	Drummond	Cobalt	Giroux Lake.
*Cobalt Lake Mining Company, Limited	Cobalt Lake	Cobalt	Cobalt.
Cochrane Mines of Cobalt, Limited	Cochrane	Cobalt	Haileybury.
Coniagas Mines, Limited, The	Coniagas	Cobalt	Cobalt.
Crown Reserve Mining Co., Limited	Crown Reserve	Cobalt	Cobalt.
Drummond Fraction	Drummond Fraction	Cobalt	Giroux Lake.
Foster Leasing Company, Limited	Foster	Cobalt	Giroux Lake.
Hudson Bay Mines, Limited, The	Hudson Bay	Cobalt	New Liskeard.
Kerr Lake Mining Company, Limited.	Kerr Lake	Cobalt	Cobalt.
La Rose Mines, Limited	La Rose	Cobalt	Cobalt.
McKinley-Darragh-Savage Mines of Cobalt, Limited	McKinley-Darragh-Savage	Cobalt	Cobalt.
Mann Mines, Limited	Mann	Gowganda	Gowganda.
Millerett Silver Mining Company, Limited	Millerett	Gowganda	Gowganda.
Nipissing Mining Company, Limited	Nipissing	Cobalt	Cobalt.
O'Brien, M. J.	O'Brien	Cobalt	Cobalt.
O'Brien, M. J.	Miller Lake-O'Brien	Gowganda	Gowganda.
Penn-Canadian Mines, Limited.	Penn-Canadian.	Cobalt	Cobalt.
Peterson Lake Silver-Cobalt Mining Co., Limited	Peterson Lake	Cobalt	Cobalt.
Right of Way Mines, Limited, The	Right-of-Way	Cobalt	Cobalt.
Seneca-Superior Silver Mines, Limited	Seneca-Superior	Cobalt	Cobalt.
Temiskaming Mining Company, Limited	Temiskaming	Cobalt	Cobalt.
Trethewey Silver-Cobalt Mine, Limited	Trethewey	Cobalt	Cobalt.
Wettlaufer-Lorrain Silver Mines, Limited	Wettlaufer-Lorrain	Lorrain Township	Silver Centre.
Non-Producing:			
Canadian Gold and Silver Mining Co., Limited			
Cobalt Provincial Mines, Limited	Provincial	Cobalt	Giroux Lake.
Colonial Mining Co., Limited	Colonial	Cobalt	Cobalt.
East Dome Mines, Limited		Cobalt	Cobalt.
Lumsden Mining Co., Limited, The	Lumsden	Cobalt	75 Sparks St., Ottawa.
York-Ontario Silver Mines, Limited	York-Ontario	Cobalt	2984 Main Street, Buffalo, N.Y.

* Now The Mining Corporation of Canada, Limited.

The By-Products of Cobalt

As is well known, the ores of the Cobalt district in addition to silver, contain cobalt, nickel and arsenic. From the ore and concentrates treated in the refineries of Ontario, these substances are recovered in the form of cobalt oxide, nickel oxide and white arsenic respectively. The first named is produced in sufficient quantity to enable the refiners to control the world's trade in this article, and the white arsenic product is an important factor in supplying the American market. The nickel from Cobalt is of comparatively little significance, in view of the vastly greater production from the nickel-copper mines of Sudbury.

Nothing is received by the mining companies for the cobalt, nickel and arsenic contained in their ores, except in occasional sales of residues resulting from the refining of high-grade ore. By far the greater part of all these minerals which come into the hands of the refiners does so free of charge, when contained in ores bought for their silver contents.

Statistics are obtainable of the quantities of such materials recovered at the refineries, but as to the ore and concentrates shipped out of the country, this is impossible owing to no assays being made or required for the sale. It has heretofore been assumed for statistical purposes that shipments of ore and concentrates from Cobalt contained on an average 3.20 per cent. cobalt, 1.47 per cent. nickel, and 14.28 per cent. arsenic, but since so large a proportion of the output is now no longer shipped away, but is refined on the spot, and so extensive has become the raising and treatment of

low grade material which contains only a small percentage of subsidiary elements, these figures have ceased to be applicable. The statistics for 1914 given in the tables contained in this Report show therefore only the quantities of cobalt, nickel and arsenic actually sold and shipped by the mines or refining works for which a money return was received. A considerable proportion is now accounted for in this way, but it is impossible to say with accuracy what that proportion is, or how much the ores as raised from the mines contained.

The yearly and total production of silver, cobalt, nickel and arsenic from the ores of Cobalt since the mines were opened is as follows:—

Table VI.—Total Production, Cobalt Mines, 1904 to 1914

Year.	Nickel.		Cobalt.		Arsenic.		Silver.		Total Value.
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Ounces.	Value.	
		$		$		$		$	$
1904....	14	3,467	16	19,960	72	903	206,875	111,887	136,217
1905....	75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906....	160	....	321	80,704	1,440	15,858	5,401,766	3,667,551	3,764,113
1907....	370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908....	612	....	1,224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909....	766	....	1,533	94,965	4,294	61,039	25,897,825	12,461,576	12,617,580
1910....	504	....	1,098	54,699	4,897	70,709	30,645,181	15,478,047	15,603,455
1911....	392	....	852	170,890	3,806	74,609	31,507,791	15,953,847	16,199,346
1912....	429	14,220	934	314,381	4,166	80,546	30,243,859	17,408,935	17,818,082
1913....	377	13,326	821	420,386	3,663	64,146	29,681,975	16,553,981	17,051,839
1914....	(a) 90	28,978	(b) 351	590,406	(c) 2,030	116,624	25,162,841	12,765,461	13,501,469
Total.	3,790	71,165	8,007	2,061,935	31,547	567,604	210,660,655	111,050,557	113,751,261

(a) Metallic contents Nickel oxide. (b) Metallic contents Cobalt oxide. (c) White arsenic or arsenious acid.

Table VII—Dividends and Bonuses by Silver and Gold Mining Companies to December 31st, 1914,

Name of Company.	Date of Incorporation.	Authorized Capital.	Capital Stock issued.	Par value per share.	Amount of Dividends and Bonuses declared to end of 1913.	Amount of Dividends and Bonuses declared during 1914.	Total of Dividends and Bonuses declared to Dec. 31, 1914.	Last Dividend or Bonus. Date declared.	Last Dividend or Bonus. Rate per cent.
		$	$	$	$ c.	$ c.	$ c.		
Beaver Consolidated Mines, Limited	Feb. 25, 1907	2,000,000	2,000,000	1.00	410,000 00	60,000 00	470,000 00	July 3, 1914	3
Buffalo Mines, Limited	April 27, 1906	1,000,000	1,000,000	1.00	2,687,000 00	100,000 00	2,787,000 00	May 28, 1914	5
Casey Cobalt Mining Company, Limited	Dec. 19, 1906	100,000	100,000	1.00	109,439 33	93,750 00	203,219 33	Apl. 22, 1914	93¾
City of Cobalt Mining Company, Limited	Oct. 5, 1906 Jan. 7, 1909	500,000 1,500,000	1,500,000	1.00	145,000 00	....	145,000 00	Apl. 15, 1909	3
Cobalt Lake Mining Company, Limited	Dec. 22, 1906	3,000,000	3,000,000	1.00	315,000 00	150,000 00	465,000 00	May 29, 1914	4
Cobalt Townsite Mining Company, Limited	May 8, 1906	100,000	45,011	1.00	842,259 61	200,000 00	1,012,259 61	Nov. 11, 1914	....
Mining Corporation of Canada, Limited	Mar. 20, 1914	2,075,000	2,075,000	1.00	....	259,375 00	259,375 00	Nov. 16, 1914	12½
Cobalt Central Mines Company, Limited	Dec. 13, 1906	5,000,000	5,000,000	1.00	192,845 00	....	192,845 00	Aug. 25, 1909	1
Cobalt Comet Mines, Limited	April 16, 1913	1,000,000	1,000,000	1.00	27,000 00	76,000 00	103,000 00	Sept. 29, 1914	2½
Cobalt Silver Queen, Limited	April 1, 1906	1,500,000	1,500,000	1.00	315,000 00	....	315,000 00	Dec. 31, 1908	3
Coniagas Mines, Limited	Nov. 24, 1906	4,000,000	1,000,000	5.00	5,920,000 00	1,320,000 00	7,240,000 00	Nov. 1, 1914	6
Crown Reserve Mining Company, Limited	Jan. 16, 1907	2,000,000	1,768,814	1.00	5,571,764 10	424,515 36	5,996,279 46	Dec. 14, 1914	3
Foster Cobalt Mining Company, Limited	Feb. 14, 1906	1,000,000	915,588	1.00	45,000 00	....	45,000 00	Jan. 1, 1907	5
Kerr Lake Mining Company, Limited	Aug. 9, 1905	40,000	40,000	100.00	5,220,000 00	614,000 00	5,834,000 00	Oct. 13, 1914	375
La Rose Mines, Limited	Feb. 21, 1907	6,000,000	6,000,000	5.00	4,603,546 84	771,000 00	5,374,546 84	Dec. 16, 1914	.32
McKinley-Darragh-Savage Mines of Cobalt, Limited	April 17, 1906	2,500,000	2,247,692	1.00	3,999,899 82	104,584 56	4,104,484 38	Dec. 4, 1914	3
Nipissing Mining Company, Limited	Dec. 16, 1904	250,000	250,000	100.00	11,998,297 25	1,235,000 00	13,233,297 25	Dec. 21 1914	12½
Peterson Lake Silver-Cobalt Mining Co., Limited	April 11, 1906	3,000,000	2,401,820	1.00	....	126,095 55	126,095 55	Dec. 10, 1914	1¾
Right of Way Mining Company, Limited	July 13, 1906	500,000	500,000	1.00	324,643 93	....	324,643 93	....	....
The Right of Way Mines, Limited	Sept. 11, 1909	2,000,000	1,685,500	1.00	202,260 00	16,855 00	219,115 00	Nov. 16 1914	1
Seneca-Superior Silver Mines, Limited	Sept. 29, 1911	500,000	178,881	1.00	*310,774 60	335,218 80	645,993 40	Dec. 15, 1914	10
Temiskaming and Hudson Bay Mining Co., Limited	July 29, 1903	25,000	7,761	1.00	1,870,401 00	69,849 00	1,940,250 00	Nov. 10, 1914	300
The Hudson Bay Mines, Limited	July 16, 1909	3,500,000	3,200,050	5.00	778,909 42	....	778,909 42	Aug. 31, 1913	2½
Temiskaming Mining Company, Limited	Nov. 16, 1906 Jan. 1, 1908	2,500,000	2,500,000	1.00	1,384,156 25	....	1,384,156 25	Apl. 18 1913	3
Trethewey Silver-Cobalt Mine, Limited	May 30, 1906 June 1, 1911	2,000,000	1,000,000	1.00	1,011,998 50	50,000 00	1,061,998 50	June 19, 1914	5
Wettlaufer-Lorrain Silver Mines, Limited	Nov. 30, 1908	1,500,000	1,416,590	1.00	637,465 50	....	637,465 50	Sept. 22, 1913	5
Total from Silver Companies	....	....	....	....	18,922,721 15	6,306,243 27	55,228,964 42		
Gold Companies.									
Hollinger Gold Mines, Limited	June 28, 1910	3,000,000	3,000,000	5.00	1,440,000 00	1,170,000 00	2,610,000 00	Dec. 31, 1914	4
Porcupine Crown Mines, Limited	May 26 1913	2,000,000	2,000,000	1.00	....	240,000 00	240,000 00	Dec. 15, 1914	3
Total Dividends in 1915	....	....	....	....	50,362,721 15	7,716,243 27	58,078,964 42		

* By clerical error in reporting Companies' statement for 1913 the Dividends, etc., for that year were given so as to total $310,274.60 instead of $310,774.60.

Dividends

Table VII is a statement showing the dividends paid and declared by silver and gold mining companies in 1914. These amounted to $7,716,243.27, of which $6,306,243.27 was derived from silver, and $1,410,000 from gold. Cobalt silver mines have, during the eleven years of their existence, returned to their shareholders in dividends $55,228,964.42, and if profits to individual owners and close corporations are added, the total will approximate $60,000,000.

Of the silver companies comprised in the list, the following have returned in dividends their entire share capital, some of them several times over:—Buffalo Mines, Limited; Casey Cobalt Mining Company, Limited; Cobalt Townsite Mining Company, Limited; Coniagas Mines, Limited; Crown Reserve Mining Company, Limited; Kerr Lake Mining Company, Limited; McKinley-Darragh-Savage Mines of Cobalt, Limited; Nipissing Mining Company, Limited; Temiskaming and Hudson Bay Mining Company, Limited (now Hudson Bay Mines, Limited).

During the year an English company, entitled Mining Corporation of Canada, took over the City of Cobalt, Cobalt Townsite and Cobalt Lake companies; consequently, future dividends earned by these mines will be credited to the consolidated company, and not to the individual properties.

In 1913 Hollinger Gold Mines, Limited, was the only gold mining company that paid a dividend. Its practice has been to make a distribution every four weeks, thus declaring 13 dividend instalments in twelve months. In 1913 and 1914 the four-weekly payment was made at the rate of 3 per cent., which, since the beginning of 1915, has been increased to 4 per cent., thus raising the rate for the year to 52 per cent. Porcupine-Crown Mines, Limited, entered the dividend-paying class in 1914. So far, Porcupine companies have returned to their shareholders $2,850,000.

Concentration

Most of the mining companies at Cobalt are now equipped with mills for concentrating their low-grade ores, which have assumed a very important place in sustaining the output of the area. In addition, there are two companies operating works for the treatment of custom ores. These are the Northern Customs Concentrators, Limited, and the Dominion Reduction Company, Limited. The plant of the former company contains 80 stamps, that of the latter 40; each has a rated capacity of 200 tons per day. The Northern Concentrators Company carries the process no further than concentration, and returns the concentrates to the mines or ships them on the latter's account, charging a rate per ton for treatment and guaranteeing the recovery of a specified percentage of silver. The Dominion Reduction Company purchases all ore outright and reduces it to bullion, making payment either in cash or bullion, according to agreement. The low-grade ore concentrated and treated last year, and the silver recovered therefrom, were as follows:—

	Tons Ore.	Ounces Silver.
At mine plants	635,035	8,915,959
At custom works	138,223	2,245,202
Total	773,258	11,161,161

Silver Smelters

The smelting companies that treat the bulk of the ores produced at Cobalt are those of the Deloro Mining and Reduction Company, Limited, situated at Deloro, in the county of Hastings; the Coniagas Reduction Company, Limited, at Thorold, and the Canadian Smelting and Refining Company, Limited, at Orillia. The works of the last-named company were consumed by fire early in 1913, but they have been rebuilt, and were again in operation during part of 1914.

The Metals Chemical Company, Limited, of Welland, and the Standard Smelting and Refining Company, Limited, of North Bay, also operate plants for the treatment of these ores, but principally for the production of cobalt and nickel oxide and white arsenic.

At the foregoing works 5,780 tons of ore and concentrates were treated during the year. From this there were recovered 9,273,247 fine ounces of silver, 3,878,822 pounds of white arsenic, 913,778 pounds of cobalt oxide, and 413,972 pounds of nickel oxide. In addition, there were obtained 151,500 pounds of cobalt and nickel oxides not separated. The workmen employed numbered 395, and the wages paid were $292,832.

The actual shipments from the refineries, with value of same, were as follows:—

Silver	oz.	9,273,247
Value of silver		$4,899,868
White arsenic	lbs.	4,059,868
Value of white arsenic		$116,624
Cobalt oxide	lbs.	643,891
Value of cobalt oxide		$518,736
Nickel oxide	lbs.	303,752
Value of nickel oxide		$27,716
Cobalt and nickel oxides not separated	lbs.	113,843
Value of cobalt and nickel oxides not separated		$45,189

The Place and Uses of Silver

In common speech, silver is linked with gold as one of the "precious metals," but this should not be permitted to obscure the fact that, unlike gold, silver is a commodity pure and simple, whose price depends upon supply and demand. The general abandonment of silver as a basis for currency systems has deprived it of any claim to fixity of value in relation to gold.

Nevertheless, the production of silver has for many years gone on at an increasing rate. This has been due in large part to the fact that the most important sources of silver are not primarily ores of that metal, but ores of gold, copper and lead which carry a sufficient proportion of silver to warrant its recovery as a by-product. Cobalt is one of the few camps where silver is worked for itself, and so far the richness of its ores has enabled the mines to produce freely, notwithstanding the low prices which in the main have prevailed since they were opened.

It is evident that the constant demand for gold, now the basis of the monetary systems of the world—increasing as it does with the increase in the trade and commerce of the nations and their determination to be prepared for conflict—and also the demand for copper and lead to satisfy the requirements of the arts of peace, to say nothing of the arts of war, tend to produce a very considerable quantity of silver, irrespective of the necessities of the moment or the prices which may prevail. Hence, there does not appear to be much likelihood of an early reversal of the tendency which has brought silver to its present low level of price.

Nor, on the other hand, is there a prospect for an immediate or serious reduction in value. The habits of nations do not easily change, and the demand for silver from India and China is undoubtedly one of the chief stays of the price.

For coinage purposes silver disputes, or rather divides, the field with gold, copper and nickel. In all countries gold is used for coins of the largest value, silver for those of medium, and copper or nickel for those of smaller computation. The fact that the present intrinsic value of silver coins is much less than their face or denomination value does not appear to detract from their usefulness, which primarily depends upon their ability to pass from one person to another without demur. That a 50-cent Canadian coin, the silver in which is worth at present price only, say. 17.34

cents,[4] or a 25-cent piece worth only 8.67 cents, circulates freely at face value is due not only to the coins being legal tender, but also to the circumstance that they were first made legal tender at a time when their nominal and real value much more nearly corresponded than they do now. Use and wont have habituated people to the situation, and silver "change" for a $5 gold piece is given and accepted without thought, and in many cases doubtless without knowledge, that if the silver and gold were both melted the latter would sell for $5, while the former would bring only $1.734. Even if silver were to sink to a point much below its present price, it is unlikely that the general acceptance of our silver coins would be seriously affected. If in the future it should become necessary to lessen the gap between the real and face value of silver coins, which could be done by lowering the denomination or increasing the weight, the many advantages of silver for coinage purposes would in all probability retain it in use. It may be observed that it is the government which coins the silver, and stamps it with its nominal value, that profits by the difference, and not at all the miner of the silver, who sells to the mint for the same price as to any other buyer. That these profits are considerable may be deduced from the fact that in Great Britain the rate of seignorage rose from 9.09 per cent. in 1870, when the average price per standard ounce of silver (925 fine) was 60½d, to 135.29 per cent. in 1913, when the price paid by the Mint had fallen to 28 1-16d. In fact, the gross profit on the coinage of silver by the British Mint of late years has been very great. In 1910 it amounted to £1,582,858, in 1912 to £1,142,538, and in 1913 to £762,964. The corresponding profit at the Ottawa Mint in 1913 was $626,926. Silver coins of a value of £1,934,404 were issued by the London Mint in 1913, and of a value of $1,175,000 by the Canadian Mint in the same year. The estimated face value of Canadian silver coin in circulation in Canada on 31st December, 1913, was $17,901,031. During that year, it may be noted, foreign silver (mainly of the United States) to the extent of $2,034,937 was deported by the Finance Department. The advantages possessed by silver as a circulating medium are thus supplemented by the financial benefit which governments all the world over derive from its coinage, and it may therefore readily be assumed that this use will afford a permanent outlet for the metal.

Another unfailing employment of silver, and one which is steadily increasing, is in the arts and manufactures. Solid silver plate, for instance, is not now the mark of luxury, or so far removed from the reach of people of moderate means as it used to be, and in proportion to the decrease in price of an article so generally desired as silver, is likely to be the increase in its use for purposes of this kind.

Effects of the War

The normal operations of the law of supply and demand were rudely interrupted in 1914. A few days' anxious suspense over the darkening skies in the Balkans was abruptly ended by the thunder blasts and lightning strokes of war. All Europe rushed to arms, and closed in the most desperate and sanguinary conflict of history. With the great nations of Europe pouring out their blood and treasure, on the one side for conquest and on the other for liberty and honour, the vocations of peace have been thrust aside. There was demand which could not be satisfied, and supply which could not get to market. Steel, lead and copper were of more importance than silver; gold was more important than all.

During the first half of the year, the course of silver prices showed nothing noteworthy. The tendency at the beginning was downward, owing to the liquidation by a strong syndicate of the heavy stocks taken over in London on the failure of the Indian Specie Bank in 1913. January prices for fine silver in New York averaged 57.572 cents. The liquidation operation completed, prices rose, and in April reached 58.519 cents. The balance of trade in India going against that country, silver fell to

[4] The statutory weight of a Canadian 50-cent piece is 180 grains, of thirty-seven fortieths or 925 fineness. There are therefore 166.5 grains of pure silver in the coin, which at 50 cents per ounce (Troy) is worth 17.34375 cents. Other silver coins are in proportion.

58.175 cents in May, to 56.471 cents in June, and to 54.678 cents in July. On 4th August Great Britain declared war on Germany. Silver became practically unsaleable, and the London market was closed from 4th to 7th August. When it was reopened, a fixed quotation of 25d. (per standard ounce) was made, and spot transactions only were authorized. The difficulty of making sales of Canadian or American silver in London was great, and the cost of freight and war insurance added to the usual charges made the price in New York at one time 6¼ cents per ounce lower than the London figure. Prices continued to go down month by month until December; the August value in New York being 54.344 cents; September, 53.290 cents; October, 50.654 cents, and November 49.082 cents. In December there was a slight reaction to 49.375 cents.

The difficulties of marketing in London have now been largely overcome, and the obstacles in the shape of German raiders which impeded exports to India and China have also disappeared. The chaotic condition of Mexico cut down materially the production of silver in that country, and although there was an increase in the United States output of about a million ounces, the profound disturbances introduced into trade and commerce the world over have greatly lessened demand and prevented any material improvement in price. The total imports of silver into Great Britain amounted to £10,700,000 in 1914 as against £13,691,921 in 1913, and £15,517,727 in 1912. Exports in 1914 were about £10,600,000, compared with £16,923,537 in 1913 and £18,333,019 in 1912. The silver exported to India in 1914 amounted in value to £5,700,000, and to China £49,650 only, as against £9,820,784 in 1913 and £12,390,704 in 1912 to India, and £851,450 and £1,909,950 to China.

At Cobalt the opening of hostilities was followed by a short period of indecision. Owing to inability to market silver some of the mines closed down entirely; but as soon as sales again became possible, practically all the companies resumed operations. Some of them, however, confined themselves to mining ore, discontinuing all exploratory work; others, whose finances enabled them to do so, lessened production and extended development; others, again, continued to break down ore, but left it in the mine. On the whole, the actual output was not interfered with so much as at one time seemed possible.

Profits were materially lowered, for while the net returns per ounce from silver went down, the cost of foodstuffs, fodder and certain mine supplies went up. Cyanide of potassium, largely made in Germany, threatened to disappear from the market. However, the British government arranged with a firm in Scotland to greatly increase its output, and a supply of this essential article was thus ensured to gold and silver miners in Canada and throughout the Empire generally, though at an advance in cost of about 25 per cent. There was also a shortage in pebbles for grinding ore, but this was to some extent overcome by obtaining a supply from Newfoundland instead of from Denmark and France, as formerly. Zinc dust, used in precipitating gold and silver from the cyanide solutions, which previous to the war came mainly from Belgium and Germany, rose in price when these supplies were cut off. It is now being obtained from the United States at a cost of 11 cents per pound at Cobalt, instead of 6¾ cents as formerly. There was a reduction in the number of men employed at the mines, due to the restriction of operations, but it is to be recorded to the credit of the mining companies that the rate of wages was fully maintained.

The outlook for the coming year is uncertain, the prospect remaining clouded by the war. Until the existing menace to peace and civilization is removed, all industries must continue to suffer, mining among them.

Cobalt

There was produced in the silver refineries of the Province a total of 913,778 pounds of cobalt oxide last year. Until the outbreak of the war, trade was good with England and the continent of Europe. Hostilities closed the continental markets, and as the requirements of America are comparatively small, there is little prospect of demand reviving on a large scale until the arts of peace once more come into their

own. Of the quantity produced, the refiners shipped 643,891 pounds, and are now accumulating stocks, partly as oxide and partly in the form of residues. Unseparated cobalt and nickel oxides were produced to the extent of 151,500 pounds, of which 113,843 pounds were marketed for $45,189. The shipments from Cobalt included smelter residues and ore, the cobalt contents of which were paid for, equal to 97 tons of metal, the money returns being $27,743.

Under the provisions of the Metal Refining Bounty Act a bounty of six cents per pound of metallic cobalt is paid on cobalt oxide produced in the Province. It is stipulated in the Act that the maximum sum payable as bounty in any one year shall be $30,000, and that if more cobalt oxide is produced than can be paid for out of the amount named at six cents per pound, the rate of bounty shall be proportionately reduced. Under similar conditions a bounty of six cents per pound is likewise payable on refined nickel or refined nickel oxide produced in Ontario. The bounty expires 10th April, 1917.

There were paid to refiners of oxides produced in the Province last year the sums shown in the following table:—

Company.	Cobalt.		Nickel.		Bounty.		Total Bounty.
	Oxide produc'd and shipped.	Metallic contents.	Oxide produc'd and shipped.	Metallic contents.	Cobalt.	Nickel.	
	lbs.	lbs.	lbs.	lbs.	$ c.	$ c.	$ c.
Deloro Mining & Reduction Co.	325,792	226,079.9	136,016	62,567	13,564 79	3,754 02	17,318 81
Coniagas Reduction Co..	302,900	197,854	162,152	108,771	11,871 24	6,526 26	18,397 50
Metals Chemical Co..........	31,413	21,812	....	....	1,308 72	....	1,308 72
Total................	660,105	445,746	298,168	171,338	26,744 75	10,280 28	37,025 03

Hitherto the chief use of cobalt has been in the form of oxide for the production of cobalt blue, and in the manufacture of porcelain, enamelled ware, etc. It seems likely that considerable employment will be found for the metal itself in the making of alloys, notably of steel, and also as a substitute for nickel in the plating of metallic objects. Experimenters affirm that for the latter purpose it possesses several advantages: (1) a lighter coating will suffice, (2) better adhesion to the plated surface, (3) more attractive colour, (4) a shorter time is required for the plating process. It is contended that by reason of its superiority in these respects cobalt will, notwithstanding its higher price, prove a strong competitor to nickel.

Why not a Cobalt Coin?

It may be permissible to point out that a still further avenue is open for the employment of cobalt. The 5-cent piece is the least desirable of our Canadian silver coins, mainly because of its smallness in size and the consequent difficulty in handling it, and especially of distinguishing it from the 10-cent piece without ocular examination. Why should it not be replaced by a coin made of pure cobalt, intermediate in size between the 10-cent piece and the 25-cent piece? Such a coin would have many advantages. It would be readily distinguishable from all other coins. It would be attractive in colour, pure cobalt being similar in appearance to pure nickel, but somewhat more silvery, and tarnishing slowly, if at all. Being very hard, it would be difficult to counterfeit. Lastly, the chief source of cobalt being for the present in Canada, a cobalt coin would be distinctively Canadian, and its introduction would strike a chord to which the national consciousness would readily respond. The coin could be called a "cobalt," just as the U. S. 5-cent piece of copper-nickel alloy is called a "nickel." By comparison, however, a pure cobalt coin would be greatly superior in appearance and every other respect to the so-called "nickel," which contains only 25 per cent. of that metal.

Nickel

There was raised from nickel-copper mines a total of 1,000,364 tons of ore last year, the output of the several companies being as follows:—Canadian Copper Company, 644,308 tons; Mond Nickel Company, 348,074 tons, and Alexo Mining Company, 7,982 tons. The ore smelted amounted to 947,053 tons, the product of which was 46,396 tons of Bessemer matte, containing 22,759 tons of nickel and 14,448 tons of copper. The value of the nickel contents of the matte is returned by the mining companies as $5,109,088, and of the copper as $2,080,034. In 1913 the quantity of nickel in matte product was 24,838 tons, the decrease in 1914 as compared with 1913 being therefore 2,079 tons. On the other hand, the copper contents rose from 12,938 tons in 1913 to 14,448 tons in 1914, an increase of 1,510 tons. The explanation is no doubt found in the fact that a much larger proportion of the matte product was turned out by the Mond Nickel Company in 1914 than in 1913, the latter company's ore containing a higher percentage of copper than those of the Canadian Copper Company. The Mond Company were enabled to increase their production because of the much larger capacity of their new works at Coniston, as compared with their old plant at Victoria Mines.

None of the matte produced at the Sudbury smelters is refined in Canada, the output of the Copper Company going to New Jersey, and of the Mond Company to Wales for further treatment and separation of the metals. It may here be said that by no means the whole nickel and copper contents of the mattes are in the refining processes produced as fine metal. In the case of the Canadian Copper Company a considerable quantity of Monel metal, which is a mixture or alloy of nickel and copper with a little iron, in practically the same proportions as those in which these metals occur in the matte, is extracted without separation of the metals; while the copper contents of the Mond Company are recovered in the form of copper sulphate, largely used as a fungicide or insecticide in the vineyards of France and the south of Europe.

On war being declared, the Canadian Copper Company greatly reduced their operations, closing all but two of their six furnaces, while the Mond Company's works remained in full blast. Before the close of the year, the former company blew in two more furnaces, and about the beginning of 1915 were once more working at maximum capacity. Since then they have begun the construction of a seventh furnace, designed to be much larger than any one in their present plant.

In 1912 and 1913 the Canadian Copper Company undertook and practically carried to completion extensive developments at their Frood, or No. 3 mine, which contains a very lage body of somewhat low-grade ore. Shafts were sunk, the mine was opened up, machinery installed, and a new town built to accommodate the company's officers and workmen and a total population of 1,200 people. All preparation was made for a large daily output of ore. Diamond drills were meantime at work on the Creighton mine, and it was found that unexpectedly large reserves of ore existed there at depth. The ore of the Creighton mine being much richer than that of the Frood, operations at the latter were suspended, and now the bulk of the material treated by the company comes, as before, from the Creighton. Last year this mine supplied 455,817 tons of the total ore raised, 58,689 tons coming from Crean Hill, 42,114 from No. 2, and 87,688 from No. 3, or Frood.

The Mond ores were derived from eight distinct sources, namely, Garson Mine, 177,379 tons; Kirkwood, 32,760; Victoria No. 1, 59,942; North Star, 18,763; Worthington mine, 37,047; Worthington No. 2, 5,471; Levack, 16,712, and from the Alexo mine, 7,526 tons; total, 355,600 tons. The last-named property is situated in Dundonald township, a short distance from Porquis Junction on the Timiskaming and Northern Ontario railway. The workings of this mine have shown the deposit to be more important than was at first apparent. They extend now to a practically uniform depth of about 80 feet and a length of 500 feet, which represents the depth and length of the ore body, in so far as it has been proved by mining. Diamond drilling is said to have shown an additional length of at least 500 feet. The ore mined has a width of 4 to 30 feet.

In the massive portions it contains about eight per cent. nickel; the disseminated ore carries about four per cent. The copper contents are five to six-tenths of one per cent. During the eight months' operations in 1914 the metallic contents of the total ore shipped represented 22 tons of copper and over 330 tons of nickel. The ore is a pyrrhotite, much resembling the Sudbury ores, and makes an admirable mixture in the smelter with the Mond Company's ores.

There is more or less nickel in the ores of the Cobalt silver mines, but only one ton in all the shipments from the camp in 1914 brought any monetary return. This was contained in a consignment of residues, and the amount received was $91.

A new alloy of iron and nickel, containing about 36 per cent. of the latter, has been invented by Dr. Charles Ed. Guillaume, who was awarded the gold medal of the Franklin Institute, Philadelphia, for his invention. The alloy is called "invar" and possesses an extremely low co-efficient of expansion on subjection to heat—about one-tenth that of iron. This quality renders it valuable for delicate mechanism, instruments of precision, standards of length, etc.

Reference has been made to a possible use of cobalt for coinage purposes. It may not be out of place to call attention to the extensive and increasing use of nickel for coins of small value in many of the leading nations of the world. Up to the end of 1912, there had been issued a total of 909,167,567 coins of pure nickel, and of 25 per cent. nickel-bronze coins no less a number than 4,543,799,571. Of the countries using pure nickel alone, Austria-Hungary, France and Turkey issued 714,251,013 pieces. Germany, Italy and Switzerland, which use both nickel and the 25 per cent. alloy, issued of the former 151,615,264 coins. In Austria-Hungary nickel unalloyed has been coined and issued regularly since 1892. In France the pure metal was adopted, for 25 centimes only, in 1903, and a new law, passed on the 4th of August, 1913, provides for the withdrawal of all these coins and of the present bronze currency, gradually replacing them with 25-centime, 10-centime and 5-centime pieces amounting in number to 820,000,000. For the requisite metal the French government is said to have secured a contract with a French nickel company at a price of 3.50 francs per kilo (£141 per ton, or, say, 30.59 cents per pound), the 1913 price in the London market being £171 per ton (say, 36.65 cents per pound).[5] Besides the countries already mentioned, the following have a nickel or nickel-bronze currency: United States, Belgium, Japan, Brazil, Greece, Argentina, Mexico, Bulgaria, Roumania, Holland, Persia, Portugal, Servia, also many other smaller nations and dependencies. By far the greater proportion of the nickel and nickel-bronze coins are of small value, ranging in value from a penny to three and one-third pence. These values are arbitrarily assigned, since the 20-centavos piece of Argentina, which is the nickel-bronze coin of the highest currency value, namely, ten pence, weighs 62 grains, while the half-cent of East Africa, which possesses the lowest vâlue—8 one-hundredths of a penny—weighs nearly half as much, or 30 grains. The weight of an English silver threepenny bit is 21.82 grains, and of a pure nickel coin equal in value 18.375 grains. The cost of the metal per million pieces of the former is £200.5, and of the latter £113.3.

Copper

The production in 1914 was 14,453 tons, of which 14,448 tons came from the Sudbury nickel-copper mines. Four tons were contained in a shipment of ore from the McKinnon mine, near Dane station on the T. & N. O. railway, and one ton was recovered from the ores concentrated from the Cobalt Comet mine. As 947,053 tons of ore were smelted at the Sudbury works, the 14,448 tons of copper contained in the resulting matte represent a recovery of 1.52 per cent. of the original copper contents of the ore. There is undoubtedly some loss of copper during treatment by leaching on the roast heaps, in the furnace slag, etc.

[5] 44th Ann. Rep., Deputy Master and Controller of the Mint, 1913, pp. 90, 91.

The development of the nickel-copper mining industry during the past five years is shown in the following table:—

Table No. VIII.—Nickel-Copper Mining, 1910 to 1914.

Schedule.		1910	1911	1912	1913	1914
Ore raised	tons	652,392	612,511	737,656	784,697	1,000,364
Ore smelted	"	628,947	610,788	725,065	823,403	947,053
Bessemer matte produced	"	35,033	32,607	41,925	47,150	46,396
Nickel contents	"	18,636	17,049	22,421	24,838	22,759
Copper contents	"	9,630	8,966	11,116	12,938	14,448
Value of Nickel	$	4,005,961	3,664,474	4,722,040	5,237,477	5,108,997
Value of Copper	$	1,374,103	1,281,118	1,581,062	1,839,438	2,080,034
Wages paid	$	1,698,184	1,830,526	2,357,889	3,291,956	3,131,520
Men employed	No.	2,156	2,439	2,850	3,512	3,464

The nickel mining concerns carrying on active work are:—

Nickel-Copper Mining Companies, 1914

Name of Company.	Name of Mine.	Location.	P.O. Address of Manager, etc.
Canadian Copper Company	Creighton, Crean Hill, No. 2, etc.	Sudbury	Copper Cliff
Mond Nickel Company, Limited	Victoria, Garson, etc.	"	Coniston
E. F. Pullen	Alexo	Dundonald Tp.	Porquis Junc.

Iron Ore

Three iron mines produced ore last year to the extent of 275,956 tons. The total shipments were 240,057 tons, including concentrates. The producing mines were the Helen and Magpie, owned by the Algoma Steel Corporation, and Moose Mountain. Concentrates were shipped by the Canada Iron Mines from stock piles at the company's plant, Trenton. Briquettes from the concentrating works at Moose Mountain and roasted ore from Magpie were also marketed.

Experimental work of much interest has for some time been in progress at the Magpie mine in the endeavour to obtain a suitable product from the siderite ore of which the deposit is composed. The roasting plant by which the sulphur and carbonic acid contents are eliminated or greatly reduced has been described in previous reports of the Bureau.[c] The product is said to be entirely satisfactory for blast furnace use, the following analysis being furnished by the company:—Iron, 50.00; phosphorus, .012; silica, 7.24; manganese, 2.85; alumina, .60; lime, 8.34; magnesia, 8.05; sulphur, .20. It is not claimed that commercial success has yet been achieved. There are large deposits of sideritic ore in northern Ontario which would become of importance if it were possible to make use of them.

Part of the Moose Mountain output consisted of cobbed ore and part of briquettes from the magnetic concentrator. The briquettes were shipped to Cleveland, and were smelted in the Republic Iron and Steel Company's blast furnaces. Mr. Fred. A. Jordan, the superintendent of Moose Mountain mine, reports that the briquettes have been received very favourably, and that the market for them is much in excess of the tonnage that the company will be able to supply for some time. Mr. Jordan gives the

[c] xxii Report, Part I, p. 107. xxiii Report, Part I, pp. 124, 125.

following analyses: (1) of the briquettes, (2) of the by-product dust from which they were made, and (3) of ore from No. 2 deposit which it is proposed to use for briquettes in 1915:—

	(1)	(2)	(3)
Iron	63.12 p.c.	46.25 p.c.	34.40 p.c.
Phosphorus	.036	.105	.052
Silica	6.52	20.48	49.40
Manganese	.05	.12	.11
Alumina	1.00	5.65	.26
Lime	1.5	5.58	1.05
Magnesia	1.53	4.56	1.52
Sulphur	.012	.06	.04

Following is a list of the iron mining companies at work in 1914:—

Iron Mining Companies, 1914

Name of Company.	Name of Mine.	Locality.	P. O. Address of Manager, etc.
Producing Companies:—			
Algoma Steel Corporation, Limited	Helen	Michipicoten	Helen Mine.
	Magpie*	Michipicoten	Magpie Mine.
Canada Iron Mines, Limited	Childs Bessemer	Hastings county.	Trenton.
Moose Mountain, Limited	Moose Mountain	Sudbury dist.	Sellwood.

*Mines not operating during 1914. Shipments made from stock pile.

Pig Iron and Steel

The quantity of pig iron made in the blast furnaces of the Province last year was 556,112 tons, having a value of $7,041,079, as compared with 648,899 tons, worth $8,719,892 in 1913—a reduction of 92,787 tons, or 14.2 per cent. in quantity, and of $1,678,813, or 19.2 per cent. in value. There were smelted 752,560 tons of foreign and 163,779 tons of Ontario ore, and 17,111 tons of scale and mill cinder. The number of employees in blast furnaces only was 533.

Business in the making of pig iron and steel was not in a prosperous condition last year. Even before the outbreak of the war there was a good deal of slackness, but after hostilities began consumption fell off to such an extent that scarcely any of the furnaces were operating at more than 50 per cent. of their capacity. Charcoal iron, being used largely for car wheels and castings for railway equipment, shared in the prevailing depression, very few orders having been placed by railway companies for material during the eighteen months previous to the end of 1914. The same cause operated to lessen the demand for steel rails, the production of which was reduced to 40 per cent. of the normal output at the close of the year. Stocks of pig iron and steel at 31st December were very low, and should there be a good harvest in 1915 the revival of demand would be immediately followed by the resumption of blast furnace operations.

The following figures summarize the course of the pig iron and steel-making industry during the last five years:—

Table IX.—Production Iron and Steel, 1910 to 1914

Schedule.	1910	1911	1912	1913	1914
Ontario ore smelted..............tons	143,284	67,631	71,589	132,708	163,779
Foreign ore smelted.............. "	678,890	848,814	1,062,071	1,095,561	752,560
Limestone for flux............... "	248,750	275,628	305,509	351,741	252,258
Coke.............................. "	471,493	577,388	660,248	706,852	590,902
Charcoal........................bush	1,133,419	1,666,897	1,886,748	2,206,191	920,045
Pig iron........................tons	447,351	526,610	589,593	648,899	556,112
Value of pig iron................. $	6,975,418	7,716,314	8,054,369	8,719,892	7,041,079
Steel...........................tons	331,321	361,581	457,817	648,948	479,320
Value of steel.................... $	7,855,407	9,505,013	8,071,339	11,230,109	7,786,303

The quantity of charcoal iron made was 9,380 tons, valued at $153,931. Of the total pig iron product, 356,569 tons were used in making steel.

The following companies were producers of pig iron in 1914:—

Makers of Pig Iron, 1914

Name of Company.	No. of Furnaces.	Fuel used.	Location.
Canadian Furnace Co..........................	1	Coke	Port Colborne.
Algoma Steel Corporation.....................	3	"	Sault Ste. Marie.
Steel Company of Canada......................	2	"	Hamilton
Standard Iron Co.............................	1	Charcoal ..	Deseronto.

Construction Materials

Construction materials comprise brick, stone, lime and cement, also sand and gravel. Every one of these products fell off in quantity and value.

Brick and Tile

Common brick decreased in number by 114,408 M, and in value by $1,116,145; the price per M, too, which was $8.20 in 1912 and $8.44 in 1913, dropped to $7.97 in 1914. All other kinds of brick were lower in production. This was true of the entire range of clay products, including pottery, drain tile and sewer pipe. The output of the clay-working industry in 1914 was 26 per cent. less in value than in 1913, the comparison being as follows:—

	1913.	1914.
Brick, Common	$3,452,352	$2,336,207
Brick, Pressed	919,741	656,944
Brick, Paving, Fancy, etc.	243,119	237,440
Pottery	52,875	25,720
Drain tile	292,767	277,530
Sewer pipe	600,297	571,756
Total	$5,561,151	$4,105,597

These figures reflect the decreased activity in the building trade which was so marked a feature of the season of 1914. Building operations in Toronto and other cities and towns, brisk during the previous two or three years, came to a virtual standstill, and the prospects for an early revival are more than doubtful.

Statistics were collected showing the kinds of raw material used in the manufacture of brick. The figures are as follows:—

	No. of Brick. M.	Value. $
Clay	209,247	1,678,924
Shale	42,098	349,411
Sand-lime	43,026	307,632
Cement	29	240
Total	294,400	2,336,207

The number of workmen employed in the brick and tile yards of the Province was 2,523, to whom were paid wages amounting to $978,498.

As regards the fuel used in firing the kilns, there was a decided variety. Wood alone was used in 61 kilns, coal in 14, natural gas in 15; 48 used wood and coal, 5 used coal, wood and coke, 6 coal and coke, 1 coke only, 1 coal and gas. One firm used producer gas made from coal. In making sand-lime brick the fuel, which in this case is generally coal, is employed in producing steam for direct application to the bricks. There were consumed in the kilns 65,079 cords of wood, 67,226 tons of coal and coke, and 140,835 M cubic feet of natural gas, having a total value of $576,334. The season for brick and tile making is in the great majority of cases a comparatively short one, the average run in 1914 being 125 days. Some of the larger brickyards on the outskirts of Toronto, however, operated practically the year round.

Following is a list of the brick and tile manufacturers reporting to the Bureau, also of the firms making pottery:—

List of Brick and Tile-making Plants

Name.	Address.	Manufacture.
Allen, Solomon	Brantford	Brick and Tile.
Alsip, George	Fort William	Brick and Tile.
Alvinston Brick & Tile Co., Limited	Alvinston	Brick and Tile.
*Armstrong, Geo. H.	Brigden	Hollow Blocks and Tile.
Ashbridge Brick Co	Toronto	Brick.
*Baeckler, William	Chesley	Brick.
Baird & Son, H. C.	Parkhill	Brick and Tile.
Baker, Geo. E.	Arnprior	Brick and Tile.
Baker Bros.	Casselman	Brick and Tile.
Barnhardt, W. H.	Stratford	Brick and Tile.
Bartonville Pressed Brick Co., Ltd.	Bartonville	Pressed Brick.
Baylis, John	Mount Dennis	Brick.
Beamsville Brick & Terra Cotta Co.	Beamsville	Pressed Brick and Tile.
Bell, David	Drew	Brick and Tile.
Bell Bros	Paisley	Brick and Tile.
Bell Bros. & Co.	Toronto	Brick.
†Belleville Pottery Co	Belleville	Pottery.
Berlin Brick Co.	Berlin	Brick and Tile.
Blake, Elias D.	Elginfield	Brick and Tile.
Bogart Bros	Southwold	Tile.
Bond & Bird	Woodstock	Brick.
Boone, Geo. H.	Thornbury	Brick.
Brampton Pressed Brick Co., Ltd.	Brampton	Pressed Brick.
Brandon Pressed Brick & Tile Co. of Milton, Limited	Milton	Pressed Brick.
Brantford Brick Co., Limited	Brantford	Brick.
Britnell & Washington	West Toronto	Brick.
Broadwell, Benj.	Kingsville	Brick and Tile.
Brown, J. W.	Vienna	Brick and Tile.

List of Brick and Tile-Making Plants.—Continued.

Name.	Address.	Manufacture.
Brown Bros. Brick Co.	West Toronto	Brick.
Brownscombe & Sons, H.	Cargill	Brick and Tile.
Bushell, Wm.	Toronto	Brick.
Butwell Brick Co.	Toronto	Brick.
Cabana, Jr., Oliver	St. Joseph	Brick and Tile.
Cairo Brick Co.	Cairo	Brick and Tile.
Card, N. B.	Harrisburg	Brick and Tile.
Canadian Pressed Brick Co., Limited	Hamilton	Pressed Brick.
Cawrse, J. W.	London	Brick.
Clark, Walter	Sarnia	Brick.
Clemens, Moses	Thamesville	Brick and Tile.
Collins, John	West Toronto	Brick.
Conway, F. P.	Stratford	Brick and Tile.
Cooper, W. H.	Hamilton	Brick.
Cornhill & Son, James	Chatham	Brick.
Cranston & Son, J.	Hamilton	Pottery.
†Crawford Bros.	Hamilton	Brick.
*Credit Forks Brick & Tile Co	Toronto	Brick and Tile.
Crowhurst, W. J.	Port Hope	Brick.
Cumberland, J. M.	Listowel	Tile.
Curtis Bros.	Peterboro'	Brick and Tile.
†Davenport, B. F.	Orwell	Brick and Tile.
†Davis & Son, John	Toronto	Pottery.
Deller & Sons, Geo.	Norwich	Brick and Tile.
Deller Bros.	Thorndale	Tile.
†Dodge, Geo.	Kerrwood	Tile.
Dominion Brick & Tile Company, Limited	Breslau	Brick.
Dominion Sewer Pipe Co., Limited	Waterdown Station	Brick.
Don Valley Brick Works	Todmorden	Common Brick, Pressed and Fancy Brick, Terra Cotta, etc.
†Dryden Timber & Power Co., Limited	Dryden	Brick.
Dublin Brick & Tile Works	Dublin	Brick and Tile.
†Dunlop & Schmidt	Pembroke	Brick.
Dungey Bros.	Sebringville	Brick and Tile.
Elliott, William	Glenannan	Brick and Tile.
Emard, Trefflé	Embrun	Brick.
†Farah, K.	New Liskeard	Brick.
Foley Consolidated Brick & Tile Co., The F. J.	West Toronto	Brick and Tile.
Fort William Brick & Tile Co	Fort William	Brick and Tile.
†Foster Pottery Co	Hamilton	Pottery.
Fox, G. J.	Dresden	Brick.
Frank, E. D.	Strathroy	Brick.
Fraser, Chas.	Blyth	Brick and Tile.
Freek, William	Barrie	Brick.
Frid Brick Co., Geo.	Hamilton	Brick.
Frid Bros.	Hamilton	Brick.
Frost, Geo. H.	Toronto	Brick.
Fuller, Geo.	Dracon	Brick and Tile.
Gardiner, William	Blenheim	Tile.
Govenlock, J. M.	Winthrop	Brick and Tile.
Gowanlock, J.	West Fort William	Brick.
Haileybury Brick & Tile Co., Limited	Haileybury	Brick and Tile.
Haist, Jos.	Crediton	Brick and Tile.
Hallett, H.	Comber	Brick and Tile.
*Hallman, J. B.	Hanover	Brick.
†Halton Brick Co., Limited	Esquesing Tp.	Pressed Brick.
Hamilton Pressed Brick Co., Limited	Hamilton	Pressed Brick.
Hamley, R. H.	Bowmanville	Brick and Tile.
Hancock, William	Hamilton	Brick.
†Hicks, David	Shelburne	Tile.
Hill & Sons, James S.	Madoc	Brick.
Hill Bros.	Essex	Brick and Tile.

List of Brick and Tile-Making Plants.—Continued.

Name.	Address.	Manufacture.
Hinde Bros.	West Toronto	Brick.
Hiscock & Sons	Cobourg	Brick.
Hitch, John	Ridgetown	Brick and Tile.
Hohl, Geo.	Lisbon	Brick and Tile.
Holton Bros.	Drew	Brick.
Howlett, Fred.	Petrolia	Brick and Tile.
Humberstone, Thos. Allan	Newton Brook	Pottery.
Irwin, J.	Norwich	Brick and Tile.
*James, Wm.	Blackwell	Brick.
†Janes, H.	Delaware	Brick and Tile.
Jervis & Son, John	Dorchester Station	Brick and Tile.
Johnson, James	Pembroke	Brick.
Kaar, John	Brownsville	Tile.
Kerr, Fred.	Crediton East	Brick and Tile.
Kingston Brick & Tile Works	Kingston	Brick and Tile.
Koebel, Joseph Z.	St. Clement's	Brick and Tile.
Kruse Bros.	Egmondville	Brick and Tile.
Kuhn, Henry J.	Crediton East	Tile.
Lainson Bros.	West Toronto	Brick.
Lang Bros.	Merrickville	Brick.
†Launders, Thos.	Fruitland	Brick.
Leamington Brick & Tile Co., Ltd.	Leamington	Brick and Tile.
†Leatherdale, R. W.	Dresden	Tile.
Lethbridge, W. W.	Steelton	Brick.
*Lichty, J. B.	Wellesley	Brick.
Light, William	Aylmer	Brick and Tile.
Lindsay, Stephen	Tupperville	Tile.
†Lines, J. C.	Earlscourt	Brick.
Lingham, W. T.	Belleville	Brick.
Logan, John	Toronto	Brick.
London Pressed Brick Co.	London	Pressed Brick.
Lowes, Gordon	Kent Centre	Brick and Tile.
Mackay Bros.	Dutton	Brick and Tile.
Markus, William, Limited	Pembroke	Brick.
Marshall, W. W.	Hamilton	Brick.
Martin, David	Thamesville	Brick and Tile.
Mason, Charles	Toronto	Brick.
*Mawhinney, Robt.	Lovat	Brick.
Maxted Bros.	Mount Dennis	Brick.
Meaford Brick Co., Limited	Meaford	Brick.
†Merkley Bros.	Casselman	Brick.
Maloney, John	Humber Bay	Brick.
Middleton, Chas.	Wyoming	Brick.
Miller, A. E. & Co.	Hamilton	Brick.
†Mills, Geo. E.	Mount Dennis	Brick.
Milton Pressed Brick & Sewer Pipe Co., Limited	Milton	Pressed Brick.
†Miner, J. T.	Kingsville	Brick and Tile.
†Moody, G. W.	Highgate	Brick and Tile.
*Montoux Bros.	Topping	Brick.
†Morley, Walker	Toronto	Brick.
Morley & Ashbridge	Toronto	Brick.
Mullinex, W. C.	Hepworth	Brick.
Munro, D. W.	Carp	Brick and Tile.
*Murray, Timothy	Gad's Hill	Brick.
†McCormick Bros.	Kingscourt	Brick and Tile.
†McCracken Corporation, Limited	Windsor	Brick and Tile.
McCredie, W.	Lyons	Brick and Tile.
*McDonald & Reasbeck	Plantagenet	Brick.
McGibbon, Dugald	Shedden	Brick and Tile.
McGrenere Brick & Tile Co.	London	Brick and Tile.
McLean Bros.	Brigden	Tile.
McLoughlin, John	London	Brick.
Napanee Brick & Tile Co., Limited	Napanee	Brick.

List of Brick and Tile-Making Plants.—Continued.

Name.	Address.	Manufacture.
National Fire Proofing Co. of Canada, Limited	Waterdown	Terra Cotta, Hollow Tile, Fire-proofing.
Nayler & Son, J. W.	Trenton	Brick.
Neal, Walter	Gananoque	Brick.
New, Edward	Hamilton	Brick.
Niagara Tile & Brick Co.	Niagara Falls	Brick and Tile.
†Norton, Alsey	Bolton	Brick and Tile.
Norton, T. W.	West Toronto	Brick.
Oakville Pressed Brick Co.	Oakville	Brick and Tile.
Odell & Sons, Wm.	Ingersoll	Brick and Tile.
Ollmann Bros.	Hamilton	Brick.
Ontario National Brick Co., Limited	Cooksville	Shale Brick.
Ontario Paving Brick Co., Limited	West Toronto	Paving Bricks and Blocks.
O'Reilly, T. E.	Ottawa	Brick.
†Ott Brick & Tile Co., Limited	Berlin	Brick.
Ottawa Brick Manufacturing Co., Limited	Ottawa	Brick.
Owen Sound Brick Co., Limited	Owen Sound	Brick.
*Paisley & Chisholm	Kingston	Brick.
Parks, H. W.	Dresden	Tile.
Paxton & Bray	St. Catharines	Brick.
Pears & Son, James	Toronto	Brick.
Pears, William	West Toronto	Brick.
Peerless Brick & Tile Co., Limited	Ottawa	Brick.
Pembroke Brick Co., The	Pembroke	Brick.
Petty, Chas.	Cherrywood	Brick and Tile.
Phillips, Thos.	St. Helen's	Tile.
Phinn, Geo. E.	Elginfield	Brick and Tile.
Piggott, Geo., & Co.	Toronto	Brick.
*Pilon, A.	Casselman	Brick.
†Piper, Murphy & Walsh	West Fort William	Brick.
Ponsford, A. E.	St. Thomas	Brick and Tile.
Port Credit Brick Co., Limited	Port Credit	Common Brick and Pressed Brick.
Port Dover Brick & Tile Co.	Port Dover	Brick and Tile.
Price, John	Toronto	Brick.
Prices, Limited	Toronto	Brick.
†Reed, Mrs. A.	Foxboro	Tile.
Rice, Geo. A.	Dresden	Brick.
†Richardson & Son, James	Kerrwood	Brick and Tile.
Ries, John	Carlsruhe	Brick and Tile.
†Rilett, David	Oil Springs	Tile.
†Robinet Brick Co., Limited	Sandwich	Brick.
Rowntree, Joshia	Mount Dennis	Brick.
Russell, Joseph	Toronto	Brick.
*Russell Brick & Tile Co., Limited	Russell	Brick and Tile.
Russell, Vincent	Burk's Falls	Brick.
Ryan, Mathew	Smith's Falls	Brick.
Ryan & Co., T. M.	Niagara Falls	Brick.
Schaefer Brick Co., Limited	New Hamburg	Brick and Tile.
*Scott, James M.	Meaford	Brick and Tile.
*Shuttleworth & Co.	Petrolia	Brick.
*Sinden, L. H.	Tillsonburg	Brick and Tile.
Sipprell, J. H.	Wilksport	Brick and Tile.
Smith, Allan G. C.	Acton	Cement Blocks and Tile.
Smith & Son, Alex.	Dutton	Brick and Tile.
Smith, W. W.	Shallow Lake	Brick and Tile.
Smith Bros.	Port Elgin	Brick.
Smyth & McDermott	West Toronto	Brick.
Snelgrove & Teers	Beaverton	Brick and Tile.
Souter & Co., G. S.	Seaforth	Brick and Tile.
Sproat, Wm. M.	Toronto	Brick.
Standard Brick Co., Limited	North Bay	Brick.

List of Brick and Tile-Making Plants.—Continued.

Steele, Edwin	Vankleek Hill	Brick.
Stickwood, Chas.	Newmarket	Brick.
Sudbury Brick Co., Limited	Sudbury	Brick.
Stratford Brick, Tile & Lumber Co.	Stratford	Brick and Tile.
Stroh, Henry	Wallenstein	Tile.
Sun Brick Co., Limited	Toronto	Brick.
Superior Brick Co., Limited	Fort William	Brick.
Surridge, F.	West Toronto	Brick.
Taylor Bros.	Kemptville	Brick.
Taylor, James	Port Hope	Pottery.
Taylor & Hall	Peterboro'	Brick, Tile and Culvert Pipe.
Terra Cotta Pressed Brick Co., Limited	Terra Cotta	Pressed Brick.
Thornton, John	Perth	Brick.
Toronto Pressed Brick & Terra Cotta of Milton, Limited	Milton	Pressed Brick.
Turnbull, Robt.	Welland	Brick.
Voakes, Ed. R.	Wheatley	Brick and Tile.
Wagstaff, A. H.	Toronto	Brick.
Waide Bros.	London	Brick.
Waite, J. E.	Forester's Falls	Brick and Tile.
Wallace & Son, R.	North Bay	Brick.
Wardle, John	Blenheim	Brick and Tile.
Warwick, Richard	London	Brick.
Waterloo Brick & Tile Co., Limited	Waterloo	Brick.
Watson Brick Co.	Bracebridge	Brick.
†Wehlann & Son	Rodney	Brick and Tile.
Weppler, Henry	Hanover	Brick and Tile.
*West Bros.	Campbellford	Brick and Tile.
Woods, W. H.	Brockville	Brick.
Workman, James	Hamilton	Brick.
Wright, Samuel	Chesley	Brick and Tile.
†Wright Bros.	Kincardine	Brick and Tile.
Yack, Louis	Walkerton	Brick.

*Not working in 1914. †No return.

List of Sand-Lime Brick Manufacturers

Name.	Address.
Canada Sand-lime Pressed Brick Co., Limited	West Toronto.
Harbour Brick Company, Limited	Toronto.
John Mann Brick Company, Limited	Brantford.
Port Arthur Sand-lime Brick Co., Limited	Port Arthur.
Schultz Bros. Company, Limited	Brantford.
Silicate Brick Company of Ottawa, Limited	Ottawa.
Toronto Brick Company, Limited	Toronto.
Wilcox Lake Brick Company, Limited	Wilcox Lake.
York Sandstone Brick Company, Limited	East Toronto.

Sewer Pipe

The three plants for the manufacture of sewer pipe produced $597,224 worth of pipe last year, and sold $571.756 worth. This is a slight falling-off from 1913, when the sales amounted to $600,297.

The names and addresses of the companies are as follows:—

List of Sewer Pipe Manufacturers

Name.	Address.
The Dominion Sewer Pipe Co., Limited	Swansea.
The Hamilton & Toronto Sewer Pipe Co., Limited	Hamilton.
The Ontario Sewer Pipe Company, Limited	Mimico.

Lime

The quantity of lime produced last year was 2,075,228 bushels, as compared with 2,300,991 bushels in 1913. The value was $333,407, as against $390,600, the average price per bushel falling from 16.9 cents to 16.5 cents.

The number of lime producers reporting to the Bureau for 1914 was 27. Small establishments in rural communities in which the farmer and his boys used to burn no small proportion of the lime required for building operations in the neighbourhood, have now well-nigh disappeared, their place being taken by fewer and better equipped plants of much larger capacity. The workmen employed in burning lime were 275 in number, who received in wages a total of $135,701. In firing the lime kilns, wood, coal, and natural gas are used; the smaller plants employing wood, and the larger ones mostly coal and a little wood. The fuel consumed had a total value of $67,519.

Below are given the names and addresses of the lime burners of the Province:—

List of Lime Producers

Name of Owner or Company.	Location.
Geo. Annis	South Orillia.
*Albert Appleyard	Georgetown.
*Edwin B. Baker	Winchester.
Beachville White Lime Co., Ltd.	Beachville.
Patrick Bergin	Napanee.
Geo. Brown	Cataraqui.
John Callan & Bros.	Innerkip.
W. M. Cameron	Carleton Place.
Canada Lime Company, Ltd.	Coboconk.
David Chalmers	Owen Sound.
Wm. D. Chestnut	Duntroon.
J. H. Duckett	Eugenia.
E. & F. Flieler	Clarendon Tp.
Wm. Foote	Varna.
*Wm. Foster	Cheltenham.
*Jno M. Frey	Elmira.
E. Harvey, Limited	Rockwood.
*J. Hebert	Casselman.
Higginson & Stevens	Hawkesbury.
*H. M. Jelly	Bowling Green.
*Kingston Penitentiary	Kingston.
*J. G. Langman	Hawkestone.
*A. R. Leslie	Puslinch.
James Marshall Lime and Cement Works	Hamilton.
*G. D. Lumsden	Holstein.
Jas. McGillivray	Priceville.
Fred McMillan	Havelock.
Peter Milton	Campbellford.
*James Moore	Foxmead.
*R. T. Parks Sons	Troy.
*Emerie Poirrier	Apple Hill.
*T. A. Poole	Perth, R.M.D., No. 3.
John A. Reeb	Port Colborne.
D. Robertson Co., Ltd.	Milton.
H. Robillard & Son	Ottawa.
John S. Smith	Inverhuron.
Standard Chemical, Iron & Lumber Co.	Eganville.
Standard White Lime Co., Ltd.	St. Marys.
The Toronto Lime Co., Ltd.	Toronto.
*Jay Walker	
Albert Wellman	Bellview.

*Idle in 1914.

Stone

The decrease in the output of the stone quarries of the Province as compared with 1913 was not so marked as in that of some of the other building materials. The production was valued at $1,088,862, a falling-off from the previous year of $48,291, or 4.2 per cent. only. The number of workmen employed was 1,288, and the wages paid amounted to $556,301.

Much the larger proportion of the quarry product in Ontario is limestone, which lends itself to a variety of purposes other than those of construction, and which outcrops freely not only in the eastern, but in the southwestern parts of the Province, in proximity to the centres of population. Sandstone is also quarried, but much more sparingly; considerable granite is marketed, chiefly in the crushed form, and a large business is being developed in taking out the so-called "trap" rock for roadmaking purposes; both at points east of Toronto and on the north shore of lake Huron. From the latter locality, it is exported for use in the United States, where, as for instance, in Cleveland, Ohio, it is used in making streets and boulevards of the finest type. There is no more suitable road material to be had anywhere than trap, which is much more durable and consequently less productive of dust than the limestone usually employed for road coverings in this Province. Unfortunately, the outcrops are not contiguous to those districts in which travel is heaviest, consequently its use is restricted by heavy freight charges.

A new industry is springing up in the production of pebbles for use in the rotary mills for grinding "clinker" in the cement factories of the Province. The seat of this industry is Port Arthur, and the pebbles come from the shores of lake Superior. They are composed of rock of igneous origin, their chief constituent being silica.

Mention has frequently been made in the Bureau's Reports of the handsome marbles, greatly varied in colour and markings, found in the neighbourhood of Bancroft, in the county of Hastings. These are now being quarried and placed upon the market.

Classified according to kind, rather than according to their uses, the quarry products of the Province last year were approximately as follows:—

Sandstone	$28,000 00
Limestone	815,000 00
Trap	167,000 00
Granite	43,000 00
Marble	35,000 00

Below is given a list of the stone quarries:—

List of Stone Quarries

Name of Owner, Firm or Company.	Location.	Kind of Stone.
Bergin, Patrick	Napanee	Rubble, etc.
Britnell & Co., Limited	Burnt River	Limestone.
Callan & Bros., John	Innerkip	do
Canada Crushed Stone Corporation, Limited	Dundas	do
*Canada Iron Corporation, Limited	Longford Mills	do
*Canadian Quarries & Construction Co., Limited.	Ottawa	Sandstone.
Canadian Quarries, Limited	Hamilton	Limestone.
Cartmell, Wm. R.	Thorold	do
Coast & Lakes Contracting Corporation	Windmill Point	do
Cook, J. S.	Wiarton	do
Credit Valley Stone Co., Limited	Credit Forks	do
Empire Limestone Co., Limited	Sherkstone	do
*Farr, L. G.	Haileybury	do
Fleming, J. H.	Glenwilliams	Sandstone.
Gallagher Lime & Stone Company, Limited	Hamilton	Limestone.
Gordon & Bruce	Lyndhurst	Red Granite.
Gosselin, Chas.	Quarries	Limestone.
Granite Crushed and Dimension, Limited	Washago	Crushed Granite.
Hagersville Contracting Co., Limited	Hagersville	Limestone.
Hagersville Crushed Stone Co., Limited	Hagersville	do
*Harrison & Beatty	Owen Sound	do
Howey, George	Nanticoke	Blue Limestone.
Intercities Quarries Co., Limited	Port Arthur	Trap.
Kennedy, R. C.	Guelph	Limestone.
Kingston Penitentiary	Portsmouth	do
Lally Estate	Smithville	do
Logan, Hugh	Georgetown	Sandstone.
Longford Quarry Co., Limited	Longford Mills	Limestone.
Maloney, John	Puslinch	do
Marshall James	Hamilton	do
Martin International Trap Rock Co., Limited	Bruce Mines	Trap Rock.
*Michigan Central Railway	Hagersville	Limestone.
Murphy, J. S.	Tweed	Limestone.
Oliver Rogers Stone Co., Limited	Owen Sound	do
Ontario Rock Co., Limited	Preneveau	Trap Rock.
Perkins, Geo. A.	Owen Sound	Limestone.
Point Anne Quarries, Limited	Point Anne	do
Queenston Quarry Co., Limited	St. Davids	do
Quinlan & Robertson, Limited	Crookston	do
Reid, Fenton	Odessa	Rubble.
Robertson, D., & Company, Limited	Milton	Limestone and Sandstone.
Robillard, H., & Son	Ottawa	Limestone.
Roddy & Monk	Kingston	do
Rogers, F., & Company	Terra Cotta	Sandstone.
Rubel Bros.	Jordan	Limestone.
St. Marys Horse Shoe Quarry, Limited	St. Marys	do
Standard Crushed Stone Company, Limited	Niagara Falls	do & Flint.
Standard White Lime Co., Limited	Beachville	do
T. Sidney Kirby Co., Limited	Ottawa	Sandstone and Limestone.
Thames Quarry Company, Limited	St. Mary's	Limestone.
Thunder Bay Contracting Co., Limited	Port Arthur	Trap Rock.
Walker Bros.	Thorold	Limestone.
Webber, John, Sr.	Byng	do
Webster, James S.	Galt	do
Welland County Lime Works Co., Limited	Port Colborne	do
Wentworth Quarry Co., Limited	Vinemount	do
William Markus, Limited	Pembroke	do
Wilson, G. S.	Manion	Sandstone.

*Idle in 1914.

Sand and Gravel

In general, there is no lack in Ontario of sand and gravel, suitable for construction work, roadmaking, etc., but there are localities in the extremity of the southwestern peninsula, and also in the clay lands of the new north, where deposits are few and far between.

Considerable accumulations of these materials are found in the waters of the Great Lakes and connecting rivers, and regulations have been provided under which licenses may be issued by the Minister of Lands, Forests and Mines, for the working of the deposits at a specified rate per cubic yard of sand or gravel removed. A typical occurrence is in the Niagara river below Bridgeburg, where the current has brought down large quantities of gravel; in fact, Strawberry and other islands in that neighbourhood owe their origin to this action of the river. The international boundary runs to the west of Strawberry island, and from the river bed on the American side the Buffalo market for gravel has been largely supplied. Authority has now been given for the removal of gravel from deposits on the Canadian side of the river, the royalty payable to the Crown being fixed at 12 cents per cubic yard. Similar concessions have been granted in Lake Erie waters and at other points, the royalty rate varying according to distance from market and other circumstances.

Royalties paid the Crown on sand and gravel removed from Crown lands during the last fiscal year amounted to $4,624.97.

Sand and gravel operators in 1914 were:—

List of Sand and Gravel Operators

Name.	Material.	Address.
Allen Bros.	Gravel	Kingston Road, Toronto.
Anderson, Alex.	Sand	St. Thomas.
Armstrong Supply Company, Limited	Gravel	Hamilton.
Barnes, William	Gravel	Stoney Creek.
Battle, John	Sand	Thorold.
Blair, James	Gravel	Arnprior.
Boss, L. A.	Sand	London.
Brick Manufacturing & Supply Co., Limited	Sand	London.
Buchanan, John Alexander	Sand	Windsor.
Buchanan, N.	Sand	Belmont.
Burns, Dean	Gravel	Pembroke.
Canada Pebble Company, Limited	Gravel (Pebbles)	Port Arthur.
Chambers, J.	Sand	Kerwood.
Clarke, Richard	Gravel	Smiths Falls.
Clifton Sand & Gravel Corporation, Limited	Sand and Gravel	Stamford.
Doyle, Michael	Gravel	Caledonia.
Doyle, William	Gravel	Caledonia.
Empire Limestone Company, Limited	Sand	Buffalo, N.Y.
Forster, F. W.	Sand	Caledonia.
Gillespie, John	Sand	Perth.
Gowland, Isaac	Gravel	Caledonia.
Griffiths, Johnston	Gravel	Pembroke.
Hagerman, Anson V.	Sand and Gravel	Fellows.
Hamilton Sand & Gravel Co.	Sand and Gravel	Hamilton.
Hamilton, Robert	Gravel	Caledonia.
Hansen, Hans Christian	Sand	7325 Clinton Ave., Cleveland, Ohio.
Harris, J. W.	Sand	Kerwood.
Healey, Frank	Gravel	Smiths Falls.
Hudson, Mrs.	Sand	Horning's Mills.
Jackson, F.	Gravel	East Toronto.
Johnson, H. L.	Sand	North Toronto.
Keefer, C. H.	Sand and Gravel	Ottawa.

List of Sand and Gravel Operators.—Continued.

Name.	Material.	Address.
Kerfoot, Geo.	Sand and Gravel	Smiths Falls.
Kilbourn, Harvey & Sons	Sand	London.
Kingston Sand & Gravel Co., Limited	Sand and Gravel	Kingston.
Leciuer, Louis	Gravel	Bowesville.
Maher, Wm.	Gravel	Weston Road, Toronto.
Mahaffey Bros.	Sand	London.
Maple Sand, Gravel & Brick Co., Limited	Sand and Gravel	Maple.
Markus William, Limited	Gravel	Pembroke.
McIntosh, J. G.	Sand	Kerwood.
McKay, Chas.	Gravel	North Toronto.
McLean, David	Sand and Gravel	Perth.
McPherson, John	Sand	Ilderton.
Moore, Geo.	Gravel	Caledonia.
Morrison, J. H.	Sand and Gravel	Brockville.
Nesbitt, Robert A.	Sand and Gravel	Ottawa.
New, Edward	Gravel	Hamilton.
Niagara Brick and Tile Company, Limited	Sand	Niagara Falls, Ont.
Nichols, H.	Gravel	Richmond Hill.
Nicholas, Gideon	Sand	Caledonia.
Ontario Sand Co., Limited	Sand	Niagara Falls.
Patterson, Thos.	Gravel	Arnprior.
Ponsford, A. E.	Sand	St. Thomas.
Porter, Thompson	Sand and Gravel	Weston Road, Toronto.
Pringle, Frank	Gravel	Weston Road. Toronto.
Penhorwood, Sydney Lewis	Sand	Sault Ste. Marie.
Prosser, Edward	Gravel	East Toronto.
Rideau Canal Supply Co., Limited	Sand	Black Rapids.
Rumble, Harry	Gravel	Maple.
Shanks, James	Gravel	Smiths Falls.
Sherwood, Geo. E.	Sand and Gravel	Brockville.
Simons, Richard W.	Sand and Gravel	105 Dalhousie St., Brantford.
Smith, Arthur	Sand	Caledonia.
Smith & Company, Home	Sand	Lambton Mills.
Soo Dredging & Towing Co., Limited	Sand and Gravel	Sault Ste. Marie.
Tack, Henry	Sand	London.
Todd, Eldoras	Gravel	Hamilton.
Toronto Plaster Co.	Sand	West Toronto.
Union Stock Yards	Sand and Gravel	West Toronto.
Webb, M. W.	Gravel	Hamilton.
Waltham, R. E.	Sand	Kerwood.
Watson, John	Sand and Gravel	Maple.
Wood, Elgin	Sand and Gravel	East Toronto.
Yates, W. H.	Sand	Sarnia.
York Sand and Gravel Co., Limited	Sand and Gravel	Hamilton.
Young, David	Gravel	Caledonia.

Portland Cement

The prevailing dulness adversely affected the production of Portland cement last year, the output being 2,665,650 barrels, valued at $2,931,190, as compared with 3,802,321 barrels in 1913, worth $4,105,455. Notwithstanding the falling-off in the demand, the average price per barrel at the factory showed no decline, but on the contrary rose from $1.079 in 1913 to $1.099 in 1914. There were actually manufactured during the year 3,061,999 barrels, but stocks on hand at the close of the year were 846,562 barrels, as compared with 450,213 barrels at the end of 1913, leaving net factory sales at the number of barrels given above.

Reference has been made in previous Reports to the growing tendency to use limestone of suitable composition in the manufacture of cement rather than shell marl, which at the beginning of the industry was exclusively employed. Last year the plants using limestone produced 2,548,476 barrels, while those using marl made only 513,523 barrels. There appears to be no marked difference in the quality of the product, provided equal care is taken in the manufacture.

Following is a list of the cement plants of the Province:—

List of Portland Cement Plants

Name of Company.	Location of Plant.	P.O. Address of Manager, etc.
Canada Cement Company, Limited, Plant No. 4.	near Belleville	Herald Bldg., Montreal, Que.
do do do No. 5.	near Belleville	do do
do do do No. 6.	near Marlbank	do do
do do do No. 7.	near Lakefield......	do do
do do do No. 8.	near Port Colborne.	do do
do do do No. 9.	near Shallow Lake..	do do
The Hanover Portland Cement Co., Limited....	Hanover	Hanover.
*The Imperial Cement Company, Limited......	Owen Sound	Owen Sound.
Kirkfield Portland Cement Company, Limited..	Raven Lake	1 Toronto St., Toronto.
*Maple Leaf Portland Cement Co., Limited.....	Atwood	Listowel.
National Portland Cement Co., Limited........	Durham	Durham.
The Ontario Portland Cement Co., Limited.....	Blue Lake	Brantford.
St. Marys Portland Cement Co., Limited......	St. Marys..........	St. Marys.
*Superior Portland Cement Co., Limited........	Orangeville	Box 134, Orangeville.

*Idle in 1914.

Arsenic

At one time white arsenic, or arsenious acid, was recovered in considerable quantity as a by-product of the auriferous arsenopyrite worked for its gold contents at Deloro in the county of Hastings, but when gold mining was given up the production of arsenic ceased also. A new and abundant source of this useful product was opened up when silver mining began at Cobalt, where the ores consist essentially of the arsenides of cobalt and nickel, the silver occurring for the most part in the native form. The silver refineries at Deloro, Thorold, Orillia and Welland, in treating ores from Cobalt, obtained a total of 3,878,322 pounds of white arsenic; their shipments were somewhat greater, amounting to 4,059,868 pounds. A bounty of one-half cent per pound is payable under the Metal Refining Bounty Act on white arsenic made from mispickel or arsenopyrite, but not from cobaltite, smaltite, niccolite or the other ores of the Cobalt silver mines. So far no claims on this bounty have been preferred.

The shipments of white arsenic for the last five years have been as follows:—

Year.	lbs.	Value.
		$
1910...........................	3,048,000	70,709
1911...........................	4,234,000	74,609
1912...........................	3,927,347	79,297
1913...........................	2,450,758	64,146
1914...........................	4,059,868	116,624
Total..................	17,719,973	405,385

The companies producing white arsenic are as follows:—

List of Arsenic Works

Name of Company.	Location of Works.	P. O. Address of Manager.
The Coniagas Reduction Company, Limited	Thorold	St. Catharines.
The Deloro Mining and Reduction Company, Limited	Deloro	Deloro.
Canadian Smelting and Refining Company, Limited	Orillia	Orillia.
Metals Chemical Company, Limited	Welland	Welland.
Standard Smelting and Refining Company, Limited	North Bay	North Bay.

Calcium Carbide

There is but one plant for the production of calcium carbide in the Province, that of the Canada Carbide Company at Merritton. There were 2,381 tons of carbide shipped out last year, as compared with 2,052 tons in 1913. The value of the consignments was $142,883.

The mining industry has afforded an outlet for a considerable quantity of carbide of calcium through the very general substitution of acetylene lamps for candles in underground operations. It is said that the cost is little, if any, greater, while the light is much stronger. There is also a gradual extension of the use of acetylene for lighting in establishments situated at a distance from natural gas plants, or where the electric current cannot be had.

Corundum

The market for corundum in 1914 was depressed, the sales being considerably less than the production. Shipments amounted to 548 tons of grain corundum, valued at $65,730. In 1913 they were 1,177 tons, worth $137,036.

The only company at present in operation is the Manufacturers' Corundum Company, Limited, whose mines are situated in Carlow and Raglan townships, near Craigmont P.O.

Feldspar

The production of feldspar in 1914 was very little short in quantity of that of the previous year, being 18,062 tons, as against 18,615 tons, but the value fell from $73,338 to $55,686. There is no export to Great Britain, and most of the product goes to the potteries of New Jersey and Ohio. The demand fell off during the latter part of the year, so much so that the quarries, which are situated near Verona on the Kingston and Pembroke railway, were practically closed, there being but little outlet for the production.

A beginning has been made in the use of feldspar for manufacturing purposes in Ontario. At Kingston a plant has been erected for making floor tiles, in which feldspar is an ingredient. There is a mill at Parham for grinding feldspar.

Efforts continue to be made to utilize feldspar as a source of potash, particularly for fertilizing purposes. A mixture of phosphatic rock and feldspar, very finely ground, is being introduced in the United States for use as a fertilizer, and may possibly be experimented with at the Ontario Agricultural College in 1915. Reference is made under the heading "Mineral Fertilizers" to the Drury process of using feldspar in the production of fertilizers.

Following are the feldspar producers:—

List of Feldspar Mines

Name of Owner, Firm or Company.	Location of Mine.	P.O. Address of Manager, etc.
Dominion Feldspar, Limited	Parham	30 Adelaide St. W., Toronto
Dominion Improvement & Development Co., Limited	N. Burgess Tp	Box 26, Perth.
Charles Jenkins	Bedford Tp	Petrolia.
Kingston Feldspar and Mining Company, Limited	Desert and Reynold mines	Kingston.
McDonald Feldspar Company, Limited	Verona	720 Traders Bank, Toronto
Ojaipee Company, Limited	Parry Sound	375 Spadina Ave., Toronto

Graphite

Two graphite properties were operated last year, by Black Donald Graphite Company, Limited, and Tonkin du Pont Graphite Company, Limited, respectively. The former is situated at Whitefish lake, near Calabogie, and the latter in Monteagle township, near Maynooth. Both companies mill and refine the ore. The total quantity of refined graphite shipped was 1,363 tons, valued at $87,167; the production of 1913 was 1,788 tons, worth $93,054.

The exportation of graphite suitable for the manufacture of crucibles was prohibited by the Dominion Government on 7th November to all foreign ports in Europe and on the Mediterranean and Black seas, with the exception of those of France, Russia (except the Baltic ports), Spain and Portugal. On 28th November, the exportation of graphite from Canada was entirely prohibited. Subsequently (10th December), this prohibition was modified to the extent of permitting the export of graphite to the United States under conditions satisfactory to the Minister of Customs. Flake graphite is the grade used in crucible-making, and in the past it has largely come from Ceylon. A proportion of the Ontario output fulfils the requirements for this purpose, and it was no doubt with the view of hampering the manufacture of crucible steel on the part of Germany and Austria that it was deemed advisable to restrict the export.

Following are the producers of graphite in Ontario:—

List of Graphite Mines

Name of Owner, Firm or Company.	Location of Mines or Works.	P. O. Address of Manager, etc.
*J. G. Allan		211 Bay Street South, Hamilton.
Black Donald Graphite Company, Limited	Whitefish lake	Calabogie.
*The Globe Refining Company, Limited	N. Elmsley Tp.	175 Cooper Street, Ottawa.
Tonkin du Pont Graphite Company, Limited	Wilberforce	Wilberforce.

*Idle in 1914.

Gypsum

In the valley of the Grand river, at Caledonia, and other points, deposits of gypsum occur in rocks of the Onondaga formation. These have been worked for many years. Latterly, owing partly to the requirements of the Portland cement industry, in which gypsum is used as a "retarder," or regulator of the setting of the product, the output of gypsum has undergone an appreciable increase.

Last year the total quantity of crude gypsum mined was 89,157 tons, of which 43,183 tons were shipped without further treatment than crushing or grinding. It is supplied in the crushed condition to Portland cement factories, and in the ground form as land plaster for fertilizing purposes. Ground and calcined gypsum amounting to 33,705 tons were used for manufacturing gypsum products, the total weight of which was 31,117 tons, valued at $162,375. In the process of calcining, 16 to 20 per cent. of the weight is driven off, and a proportion of hair, etc., is added in making wall plaster and the other articles of gypsum manufacture.

The gypsum beds found on the banks of several of the tributaries of Moose river which empties into James bay, have been described in previous Reports of the Bureau of Mines, but are yet so distant from means of communication and transport that little or nothing has been done upon them by way of exploitation.

Gypsum mines are as follows:—

List of Gypsum Mines

Name of Owner, Firm or Company.	Location of Mines	P.O. Address of Manager, etc.
The Alabastine Company of Paris, Limited	Caledonia	Paris.
Crown Gypsum Company, Limited	Lythmore	Lythmore.
*William Smith	Caledonia	Caledonia.

* Not producing in 1914.

Iron Pyrites

Iron pyrites is another of the exceptions to the rule of decreases which prevailed in 1914, the production of this mineral rising from 71,620 tons, worth $171,687, in 1913, to 107,258 tons, worth $264,722, last year. The principal producer was the Northern Pyrites Company, from whose mines at Northpines, near lake Minnitaki, at the junction of the Lake Superior branch of the Grand Trunk Pacific railway and the main line, large shipments were made to the United States. The Nichols Chemical Company continue to operate their mine and acid plant at Sulphide, Hastings county. A certain amount of development work has been done on the extensive showings of iron pyrites at Goudreau lake in Michipicoten district, and some trial shipments from these deposits were made last year.

Indirectly, the war had a stimulating effect on the U. S. demand for pyrite from Ontario. Most of the exports go to the central part of the United States, where foreign competition is little felt, even in normal times. Freight rates from Spain to the Atlantic ports of the United States rose after the war broke out from eight or nine shillings per ton to 12 or 13 shillings, and considerable difficulty was experienced in securing bottoms even at the enhanced figures. Naturally the effect of the rise in freight was to restrict importations from Europe, not only of pyrite but also of sulphur, and to widen the area in the States in which pyrite from Ontario might be sold. It is largely used in the production of sulphurous fumes in the manufacture of pulp and paper.

Shipments of pyrite for the last five years have been as follows:—

Year.	Tons.	Value.
1910	33,812	98,353
1911	43,629	118,457
1912	20,744	71,043
1913	71,620	171,687
1914	107,258	264,722
Total	277,063	724,262

It will be observed that every year has shown an increase over its predecessor except 1912, and that an advance in quantity of 217 per cent. has been accompanied by a fall in the selling price at the mines from $2.90 to $2.42 per ton.

The producers of iron pyrites in 1914 were the following:—

Iron Pyrite Producers, 1914

Name of Owner, Firm or Company.	Location or Name of Mine.	P. O. Address of Manager, etc.
Algoma Steel Corporation, Limited	Helen	Sault Ste. Marie.
Canadian Sulphur Ore Company, Limited	Queensboro	404 Lumsden Building, Toronto.
Nichols Chemical Company, Limited	Sulphide	Sulphide.
Northern Pyrites Company, Limited	Vermilion Lake	Northpines.
Sulphide Chemical Company, Limited	Sulphide	Sulphide.

Mica

Some six firms produced 349 tons of thumb-trimmed mica last year, the value of which is placed at $40,402. This was a somewhat smaller output than in 1913, when the production was 386 tons, worth $55,264. The larger proportion came from the deposits of the Loughborough Mining Company and was destined for use in the manufacture of electrical apparatus.

The individuals, companies and firms engaged in the business are:—

List of Mica Mines and Companies

Name of Owner, Firm or Company.	Name or Location of Mine.	P.O. Address of Manager, etc.
*G. E. Allard	Loughborough Tp.	Rochester, N.Y.
*Birch Lake Mining Co., Limited, The	Gould lake	115 York St., Ottawa.
*Brockville Mining Company	South Crosby Tp.	Elgin.
*Dominion Improvement & Development Co.	North Burgess Tp.	Box 26, Perth.
*Dominion Mineral Exploration Syndicate	Loughborough Tp.	Box 148, Sydenham.
Frontenac Mica Co., Limited	Sydenham	Timmins.
Wm. E. & S. Silas, C. Ennis	Tett's mine, Bedford Tp.	Perth Road.
Kent Bros. & J. M. Stoness	Taggart mine	Kingston.
*Kingston Feldspar and Mining Company		Kingston.
Loughborough Mining Co., Limited, The	Lacey mine	Sydenham.
W. L. McLaren	North Burgess Tp.	Perth.
New York & Ontario Mica Co., Limited		Perth Road.
*Scriven and Whyte	Sydenham	Sydenham.
Tett Bros.	Bedford Tp.	Bedford Mills.
*J. W. Trousdale	Gould lake	Sydenham.
*Edward Watts and J. J. Noble		Perth.

Those marked * did not produce any mica in 1914.

Natural Gas

The productive gas area of Ontario covers, with gaps, nearly the whole northern shore of lake Erie from Welland county on the east to Essex county on the west, and now furnishes this ideal fuel to a large proportion of the urban dwellers in this thickly settled part of the Province, and to not a few farmers as well. The output of the wells is returned as 14,063 million cubic feet, worth $2,346,687. Compared with 1913, the yield was greater by 1,547 million cubic feet, but the total valuation by well-owners was $15,334 less. This valuation, it should be noted, is by no means the equivalent of the gross sum paid by the ultimate consumers of the gas. Much of the product is disposed of by well-owners to companies which pipe the gas to cities or towns where it is sold, and in such cases the value returned to the Bureau is the price received by the well-owner or first seller, and not that obtained by the pipe or delivering company from its customers. The average value per thousand cubic feet represented by the Bureau's figures is 16.68 cents.

The increase in the production of gas as compared with 1913 was in the main due to drawing more heavily on the Kent field. The Welland-Haldimand field showed a decrease of about 700 million feet from last year's figures. By fields, the yield was:—

	Million cubic feet.		
Welland, Haldimand, etc.	3,306.0	or 23.5	per cent.
Kent county	10,121.6	" 71.9	"
Elgin county	465.6	" 3.3	"
Lambton county	169.6	" 1.3	"
Total	14,062.8	100.0	

The yield from the several fields up to the end of 1914 is of interest. Unfortunately, it cannot be given completely in every case, since in the older Welland-Haldimand field no records exist of the earlier years of production. From 1906 to the end of 1914 the total production for this field was 33,313 million cubic feet. In the case of the Kent field, discovered in 1907, the figures are complete, and amount to 41,230 million cubic feet. This includes an estimate of the waste in the early days after the discovery of this area. For the Elgin field the total now amounts to 1,514.6 million feet, and for Lambton county 169.6 million cubic feet. There was a small production from Lambton county in 1913 which is not included in these figures.

Probably the most notable feature of the year was the failure of the discovery at Oil Springs to fulfil expectations. The gas here is deep-seated, being struck at a depth of 1,900 or 2,000 feet, and is of excellent quality. When gas was first struck the rock pressure in some cases was as high as 840 pounds. During the past two years 21 wells have been drilled, of which 10 only are supplying gas to customers, while 11 have been abandoned and plugged. It is likely that drilling will be continued during the season of 1915.

In February, 1915, a good flow of gas was struck in Delaware township at a depth of about 1,200 feet. The pressure and volume are both considerable, and the quality of the gas is good. Much drilling has been done in this locality for some nine years past, but this is the first good strike.

Two gas and oil well Inspectors are kept constantly in the field for the purpose of enforcing the provisions of the statute regarding the wasting of natural gas and the plugging of abandoned wells. Mr. John Scott, of Petrolia, has charge of the oil field of Lambton county and the gas wells of that area. Mr. Donald A. Sharpe, whose

duties as Inspector were exercised in the Welland-Haldimand-Norfolk gas field, resigned his position in 1914, and is now member of the Legislative Assembly for the county of Welland. He was succeeded by Mr. A. E. Near, of Gas Line P.O. Mr. Joseph Beno, of Tilbury, is local Inspector for the Tilbury gas field, where there have been some cases of interference with the domestic water supply by the putting down of gas wells.

Inspector Near reports that considerable drilling for gas was done in his district during the past year, with successful results. The two largest producers are the Dominion Natural Gas Company of Hamilton, and the Provincial Natural Gas and Fuel Company of Niagara Falls. The former drilled 22 wells in 1914, of which 21 proved to be productive, thus raising the number of producing wells operated by this company to 348. The total quantity of gas drawn from the company's wells was 2,914 million cubic feet, which, along with 1,424 million cubic feet purchased from other producers, enabled them to supply upwards of 27,000 customers during the year. The Dominion company also receives a considerable quantity of gas from the Southern Ontario Gas Company, Limited, taken from the Tilbury gas field. This gas, although containing a proportion of sulphur, is suitable for industrial uses, and is being supplied to manufacturers in Hamilton, but not for domestic consumption in that city. Gas from the Tilbury field is also being piped to Brantford, Paris, Galt, Hagersville, Jarvis and other places to which the company's lines extend.

The Provincial Natural Gas and Fuel Company drilled 17 producing wells last season in the Welland county field, making a total of 215 producing wells owned by the company. The total product from these wells was 712 million cubic feet, which was supplied to 5,500 customers in Niagara Falls, Welland, Bridgeburg, Fort Erie, Stevensville and Crystal Beach.

The National Gas Company of Hamilton have drilled in the townships of Seneca and Binbrook 45 producing wells, having an aggregate open flow of about 20 million cubic feet. They have recently laid a pipe line from this field into the city of Hamilton, comprising seven miles of 12-inch pipe, four miles of 10-inch, and four miles of 8-inch, in all about 15 miles of pipe. This company have also a gas tract in Rainham and South Cayuga townships, with 28 producing wells having an aggregate open flow of about 8 million cubic feet.

The list of natural gas producers for 1914 was as follows:—

List of Natural Gas Producers

Name of Person or Company.	Locality.	P.O. Address of Manager, etc.
Aldrich Gas & Oil Company, Limited, The...	Haldimand county..	Selkirk.
Beaver Oil & Gas Co., Limited, The.........	Romney Tp.........	66½ Market Street, Brantford.
Beck and Aikens	S. Cayuga and Dunn Tps.	Dunnville.
Bertie Natural Gas Company, Limited.......	Bertie Tp.	Ridgeway.
Brantford Gas Co. (Distributors only)		
Canadian Gas Company, Limited	Kent county........	1426 Dime Bank Building, Detroit, Mich.
Canfield Natural Gas Company, Limited.....	Canfield	Canfield.
Chippewa Oil & Gas Company, Limited, The..	Lincoln and Haldimand counties...	Tavistock.
Coleman, J. A.	Wainfleet Tp.......	Wellandport.
Commonwealth Oil and Gas Co., Limited.....	Onondaga Tp.......	165 Bay St. West, Hamilton.
Crystal Oil and Gas Co., Limited, The.......	Onondaga Tp.......	Paris.
Danskin, D.	Brantford Tp.......	Cainsville.

List of Natural Gas Producers.—Continued.

Name of Person or Company.	Locality.	P.O. Address of Manager, etc.
Dominion Natural Gas Co., Limited, The	Lincoln, Wentworth Elgin, Norfolk and Haldimand counties	842 Marine Bldg., Buffalo, N.Y.
Dunn Natural Gas Company, Limited, The	Dunn Tp.	Dunnville.
Eastside Gas Co., Limited	Sherbrooke Tp.	Port Maitland.
Empire Limestone Company, Limited	Welland county	Buffalo, N.Y.
Enterprise Gas Company, Limited	Norfolk county	842 Marine Bldg., Buffalo, N.Y.
Fisherville Gas Co. No. 1	Fisherville	Fisherville.
Glenwood Natural Gas Co., Limited	Raleigh, Romney and Tilbury East Tps.	Buffalo, N.Y.
Hager, Ham		Middleport.
Hamilton, Alex. M.		Cainsville.
Hagersville Light and Fuel Co., Limited	Hagersville	Hagersville.
Holmes Gas Company, Limited	Rainham & Walpole Tps.	Selkirk.
Home Natural Gas Company, Limited	Oneida Tp.	City Hall, Hamilton.
Hoover, D. E.	Rainham Tp.	Rainham Centre.
Hoover, D. E., A. E., and Menno	Rainham Tp.	Rainham Centre.
Hoover, James E.	Walpole Tp.	Selkirk.
Humberstone Mutual Natural Gas & Fuel Co., Limited	Humberstone	Humberstone.
Hyde & Snively	South Cayuga Tp.	Dunnville.
Industrial Natural Gas Company, Limited	Crowland and Humberstone Tps.	Port Robinson.
Jones, James S.	Port Maitland	Port Maitland.
Kindy Gas Co., Limited	Rainham Tp.	Rainham.
Kindy, D., and Sons	Rainham Tp.	Selkirk.
Kohler and Aikens	Canboro Tp.	Dunnville.
Lalor, F. R.	Dunnville	Dunnville.
Lamb, Alfred	Walpole Tp.	Selkirk.
Lamb, Walter B. and R. W. Lamb	Walpole Tp.	Nanticoke.
Lint and Emerson	Canborough Tp.	Attercliffe Station.
Manufacturers Natural Gas Co., Limited (Distributor)		842 Marine Bldg., Buffalo, N.Y.
Maple City Oil & Gas Co., Limited	Raleigh, Romney, Tilbury East Tps.	Buffalo, N.Y.
Marshall, James	Haldimand county	Hamilton.
Martin, Edward	Port Maitland	Port Maitland.
Mayer and Ross	Humberstone Tp.	202 Mutual Life Bldg., Buffalo, N.Y.
Medina Natural Gas Company, Limited, The	Elgin county	Chatham.
Midfield Natural Gas Company, Limited	North Cayuga Tp.	32 Stinson St., Hamilton.
Moote, Melick and Lymburner	Haldimand county	Canborough.
Nanticoke Natural Gas Co., Limited, The	Nanticoke	Nanticoke.
National Gas Company, Limited	Haldimand & Wentworth counties	Rainham Centre.
Niagara Natural Gas and Fuel Co., Limited	Humberstone Tp.	Sherkston.
Norfolk Gas Company, Limited	Norfolk county	842 Marine Bldg., Buffalo, N.Y.
North Shore Gas Company, Limited	Shore of lake Erie	Hamilton.
Northwestern Gas Company, Limited	Brant county	15 Scott Block, Erie, Pa.
Onondaga Oil and Gas Co., Limited, The	Onondaga Tp.	Brantford.
Port Colborne-Welland Natural Gas and Oil Company, Limited, The	Brant and Haldimand counties	Port Colborne.

List of Natural Gas Producers.—Continued.

Name of Person or Company.	Locality.	P.O. Address of Manager, etc.
Port Rowan Natural Gas Company, Limited	Norfolk county	842 Marine Bldg., Buffalo, N.Y.
Producers Natural Gas Company, Limited	Haldimand county	842 Marine Bldg., Buffalo, N.Y.
Provincial Natural Gas and Fuel Company of Ontario, Limited, The	Welland county	Niagara Falls, Ont.
Rolston, James, and Bennett, Robert	Canborough Tp.	Dunnville.
Snively, F. L.	Rainham and South Cayuga Tps.	Dunnville.
Southern Ontario Gas Company, Limited (Distributors)		St. Thomas.
Standard Natural Gas Company, Limited	Onondaga Tp.	Dunnville.
Standard Oil Company of Canada, Limited	Humberstone and Moulton Tps.	Port Colborne.
Sterling Gas Company, Limited	Kent county	Tilbury, Ont.
Telephone City Oil and Gas Co., Limited	Onondaga Tp.	Brantford.
Union Natural Gas Co. of Canada, Limited, The	Kent county	Niagara Falls, Ont.
United Gas Companies, Limited, The	Wainfleet Tp.	St. Catharines.
United Gas & Fuel Co. of Hamilton, Limited (Distributors)	....	72 James Street N., Hamilton.
Vansickle, A. W.	Onondaga Tp.	Onondaga.
Waines & Root Gas Co., Limited, The	Canborough, S. Cayuga, Dunn, Rainham & Walpole Tps.	Dunnville.
Welland County Lime Works Co., Limited	Port Colborne	Port Colborne.
Wedrick, M.	Walpole Tp.	Nanticoke.

Petroleum

The statistics of 1914 record another decline in the production of crude petroleum, the yield falling from 7,915,761 Imperial gallons in 1913 to 7,437,356 gallons last year, a reduction of 6 per cent. The value decreased by $60,184, or 15 per cent., the average price per barrel (35 gals.) being $1.59 in 1914, as against $1.80 the previous year, exclusive of bounty. The bounty is at the rate of 1½ cents per Imperial gallon, and is payable by the Dominion Government, on all crude petroleum produced in Canada.

Mr. J. C. Waddell, of Petrolia, who is supervisor of petroleum bounties, supplies the following figures showing production by districts:—

	Imp. gal.
Lambton	5,396,513
Bothwell	1,188,635
Dutton	76,645
Tilbury	[illegible]
Onondaga	85,310
Belle River	41,686
Total	7,437,356

It may be noted that Lambton district shows a very slight decline from last year, when its production was 155,747 bbl. or 5,451,145 gallons, but a positive increase over 1912, when the yield was 150,272 bbl., or 5,259,520 gallons. The sustained flow in this, the most important area of the oil field, is attributed largely to plugging the old wells and stopping the downflow of fresh water. The next area in point of production is Bothwell, which also has well maintained its output during the same time, the yield in 1912 being 34,486 bbl.; in 1913, 34,348 bbl., and in 1914, 33,961 bbl. Careful manage-

ment of properties by competent oil men, the plugging of all abandoned holes, and not overcrowding wells in the oil area, have contributed largely to prolonging the life of the Bothwell pool. The great falling-off has been in Tilbury, Dutton and Onondaga. The first-named area gave 44,727 bbl. in 1912, 26,824 in 1913, and 18,530 in 1914. Dutton yielded 4,335 bbl. in 1912, 4,610 in 1913, and 2,189 in 1914. The Onondaga pool is of recent working. It produced 7,115 bbl. in 1912, 4,172 in 1913, and 2,437 last year. Belle River in Essex county began production in 1913, when it yielded 465 bbl.; last year it yielded 1,191.

On the whole there was not much activity in the oil districts last year, the decline in the price of crude acting as a deterrent upon new enterprises. The price in January was $1.89 per barrel; it fell in April to $1.79, dropped in May to $1.64, in June to $1.56, in August to $1.48½, and in September to $1.38½. It declined again in October to $1.33, remaining at that figure until the end of the year.

It will be observed that the domestic crude now occupies a very subordinate place in the manufacture of the petroleum products required for Canadian use. The bulk of the crude oil required is imported from the United States.

The operations of the oil refineries for the year are shown in the following table:

Petroleum and Petroleum Products, 1910 to 1914

Schedule.		1910	1911	1912	1913	1914
Crude produced....	Imp. gal.	11,004,357	10,102,081	8,432,730	7,915,761	7,437,356
Crude distilled.....	"	36,171,032	38.632,504	46,270,701	53,821,592	73,239,403
Value crude produced	$	368,153	353,573	344,537	381,159	337,867
Value distilled products	$	2,511,368	2,294,396	3,592,230	3,068,312	3,360,913
Illuminating oil...	Imp. gal.	18,983,357	20,240,523	23,090,280	21,415,010	28,817,830
Lubricating oil...	"	4,469,038	4.729,257	5.932.166	6,144,193	6,228 394
Benzine and naphtha	"	4,297,615	4,179,575	4,955,022	7,349,015	13,542,383
Gas and fuel oils and tar	"	5,876,498	4,847,124	6,028.983	10,157,948	10,747,838
Paraffin wax and candles.........	lb.	5,179,391	5,267,485	8,086,841	10,153,806	11,053,058
Workmen employed.	No.	428	511	699	781	925
Wages paid	$	280,485	314,851	436,852	559,556	683,247

The petroleum refining companies are:—

Canadian Oil Company, Limited, Petrolia, Ont.

Imperial Oil Company, Limited, Sarnia, Ont.

Quartz

There was a decline in the production of quartz in 1914 as compared with 1913, but the falling-off was less marked in quantity than in value, the output being 52,947 tons, as against 54,320 tons in the previous year, and the value $82,544, as against $130,860. The Canadian Copper Company continue to be the chief operators, the product of their quarries in Dill township being used as a flux for smelting their nickel-copper ores. A little quartz is obtained from dikes of this material encountered in the feldspar quarries at Verona.

Following are the firms or companies raising quartz:—

List of Quartz Producers

Name of Owner, Firm or Company.	Location of Mines.	P.O. Address of Manager, etc.
The Canadian Copper Company, Limited	Dill	42 Exchange Place, New York.
Kingston Feldspar & Mining Co., Limited	Desert Lake and Reynolds mines	Kingston.
The McPhail & Wright Construction Co., Ltd.	Mile 19, A. C. Ry.	Sault Ste. Marie.
The Mond Nickel Company, Limited	Neelon Tp.	Coniston.
A. B. Willmott	Killarney	404 Lumsden Bldg., Toronto.

Salt

The quantity of salt produced in Ontario does not vary greatly from year to year. It all comes from the brine wells on the shores of lakes Huron and St. Clair and in the neighbourhood of St. Clair and Detroit rivers. The deposits of salt in this part of the Province are thick and extensive, and are now furnishing the raw material for the manufacture of chlorine and sodium compounds, as well as for the production of sodium chloride or common salt. By manipulating the processes of evaporation and treatment the size of the salt crystals is varied, and so are produced the grades required for table, dairy, and other uses. Land salt is the coarser and impurer portion of the product. It does not supply any of the fertilizing elements, but has certain beneficial effects in the way of strengthening and stiffening the stalks of grain, etc.

The output of the wells in 1914 was 104,744 tons, valued at $498,383. Of this 75,054 tons were of the fine, table and dairy qualities, 28,709 tons of the coarse, and 1,011 tons land salt.

Following is a list of the salt-producing firms and companies:—

List of Salt Companies

Name of Owner, Firm or Company.	Location of Wells or Works.	P.O. Address of manager, etc.
The Canadian Salt Company, Limited	Windsor Sandwich	Windsor.
*Carter & Kittermaster	Mooretown	175 Christina St., S., Sarnia.
The Dominion Salt Company, Limited	Sarnia	Sarnia.
The Elarton Salt Works Company, Limited	South of Egremont Road	Hyde Park.
Exeter Salt Works Company, Limited	Exeter	Exeter.
The Gray, Young & Sparling Company of Ontario, Limited	Wingham	Wingham.
North American Chemical Co., Limited	Goderich	P.O. Box 29, Clinton.
Ontario People's Salt & Soda Co., Limited	Kincardine	Kincardine.
John Ransford	Stapleton	Clinton.
Western Canada Flour Mills Co., Limited	Goderich	Goderich.
The Western Salt Company, Limited	Mooretown and Courtright	Courtright.

*Not producing in 1914.

Miscellaneous

The talc industry in Hastings county did not experience any adverse effects of the war until the beginning of December, when ocean freights were raised to a point which quite shut off exports to Great Britain. The demand in that country existed,

but was being filled by imports from France, Italy and probably other European sources, freight rates from which to England were very little above the normal. Crude talc, mined in 1914, amounted to 13,055 tons; of the quantity shipped, 1,694 tons went to market in an unmanufactured condition. The remainder was ground, and 8,866 tons of the several grades were shipped by the grinding plants. Geo. H. Gillespie and Company, Limited, Madoc, and Eldorite, Limited, Eldorado, operate mills for the preparation of talc. Until conditions abroad improve, the trade will necessarily be limited to the United States and Canada. This will have a tendency to reduce the output, as the British market is important.

A small quantity of peat fuel was manufactured by the Canadian Peat Company, Limited, of Alfred, Ont. About 600 tons were sold, having a value of $2,100.

Some 400 tons of phosphate of lime were shipped last year from a deposit in Lanark county, the value being placed at $3,150.

Mineral Fertilizers

The chief elements upon which the fertility of the soil and consequently the welfare of agriculture depends, are phosphorus, potash and nitrogen.

Phosphorus

Ontario and Quebec have in the past produced considerable quantities of phosphate of lime, or apatite, from which by treatment with sulphuric acid, super-phosphates of lime are obtained, supplying vegetation with phosphorus in an available condition. The business of phosphate mining, however, came to an end a number of years ago when phosphatic rock began to be mined in some of the Southern States and elsewhere, and has not since been revived. The Canadian article was much richer in phosphoric acid, but could not be placed on the market at a figure to compete with the American product. There is no doubt that supplies could still be had if it were profitable to work the deposits.

Potash

The question of obtaining potash for fertilizing purposes was a live one on the continent of America before the European war began, but the war has given it still greater emphasis. Germany has the largest known deposits of potash, and while in times of peace she controlled them with an iron hand and with an eye single to her own interests, when hostilities were proclaimed exports were entirely cut off. Systematic exploration for sources of potash within the borders of the United States has been for some time carried on by the government of that country with only a measure of success. The beds of dried-up lakes in the arid regions of the west, the masses of kelp, a species of seaweed thrown up on the western coast by the waters of the Pacific ocean, the mineral feldspar, have all been examined and investigated, and doubtless will be made to yield a certain quantity of potash until peace once more enables the German stores to be drawn upon. For our own Province the possibilities of feldspar deserve attention, for there are large supplies of this material, particularly on the line of the Kingston and Pembroke railway, which carry 12 or 13 per cent of potash. The difficulty has hitherto been the want of a practicable process which will isolate the potash, or at any rate put it in a soluble form and so enable the growing plant to take it up from the soil. Simply to reduce the feldspar to a powder by grinding it does not seem to meet the requirements; or at any rate if such a process results ultimately in the liberation of the potash through the action of the acids in the soil, the operation is so slow that little or no immediate benefit is obtained.

Mr. C. W. Drury, associate professor of Mining and Metallurgy at Queen's University, Kingston, claims to have perfected a process by which without extracting the potash contents of feldspar, they are rendered sufficiently soluble to admit of their

being assimilated by the plant roots. The process is a simple one, being as follows: Crushed feldspar is mixed with limestone and iron ore, and with a quantity of coke to melt the mixture is charged into a blast furnace. The molten slag is tapped from the furnace and the slag ground. The ground slag is then used as a fertilizer either alone or mixed with phosphoric acid and nitrogen compounds to form a "complete" fertilizer. Prof. Drury finds the potash in the ground slag is soluble in a one per cent. solution of citric acid, the latter being regarded as equivalent in action to the acids of the soil, which are not capable of isolation. Experiments are to be made at the Ontario Agricultural College, Guelph, to test the efficacy of the Drury feldspar slag.

Another source of potash is the sugar beet. At the works of the Dominion Sugar Company, Limited, in Berlin and Wallaceburg, some 3,200 tons of material are obtained yearly, which will give a quantity of potash equal approximately to 800 tons of muriate of potash. About 8,500 tons of potash are imported into Canada annually, so that the contribution of the sugar factories is of considerable importance. The process of recovering the potash is briefly as follows: after most of the sugar is extracted from the pulp, certain residues are left in the form of molasses. What additional sugar can be extracted from the molasses is obtained by treatment with barium. The remaining liquor, termed "mother liquor," contains 10.84 per cent. of potash and 3.6 per cent. of nitrogen; the total ash is 18.76 per cent., and of this 57.78 per cent. is potash. The "mother liquor" is concentrated in a partial vacuum without destroying the nitrogen, and a product is obtained containing about 4 per cent. of nitrogen, and 11 or 12 per cent. of potash. This is disposed of to the fertilizer manufacturers, who mix it with nitrogen and phosphate for manurial use.

The agricultural use of potash is by no means the only one, since it enters largely into the manufacture of chemicals, the United States requiring 12,000 or 15,000 tons annually for this purpose.

Nitrogen

The remaining element essential for the growth of plants is nitrogen. The atmospheric envelope which surrounds the globe is a vast reservoir of nitrogen, but it is only in very recent times that successful attempts have been made to capture the free nitrogen of the air and compel it to serve the needs of the agriculturist. Two leading processes have been developed for the fixation of atmospheric nitrogen, entitled respectively the "arc" and the "cyanamid" processes.

The arc or calcium nitrate method proceeds by means of the electric arc, in the intense heat of which the nitrogen and oxygen of the air are caused to form nitrous fumes; these are passed over water trickling through granite towers filled with broken quartz, to form a weak nitric acid, and through iron towers percolated by a solution of soda, where sodium nitrite results. Ninety-seven per cent. of the nitrous fumes are thus absorbed. The nitric acid is passed on to granite vats filled with limestone, where a watery solution of calcium nitrite is formed, to be later evaporated to dryness. The sodium nitrate solution is evaporated and allowed to crystallize. Calcium nitrate has as high a fertilizing value as sodium nitrate, the natural product from Chili. Other valuable substances are produced, such as concentrated nitric acid and ammonium nitrate.

In the cyanamid process calcium carbide is formed in the electric furnace by the fusion of calcium and carbon—say lime and coke. The calcium carbide is finely ground and treated in a second set of furnaces with nitrogen gas of high degree of purity, the nitrogen being obtained by the mechanical liquefaction of air and its coincident fractional distillation. The product from the secondary furnaces is crushed and reduced to the form of powder, which is hydrated to remove the caustic lime. It is then ready for direct application to the soil, either alone or in combination with other plant foods. From cyanamid may be obtained a long series of derivatives, such as ammonia, nitric acid, ammonium nitrate, and, what is of special interest to gold and

silver mining companies at the present time, a cheap cyanide of potassium which is said to be quite as effective in dissolving gold and silver as the article manufactured in the ordinary way.

Both processes of nitrogen fixation depend upon abundant and cheap water power for the generation of the electric current. The arc process has been highly developed in Norway, where a company headed by Dr. Samuel Eyde operates a plant employing 200,000 continuous horse-power. Enlargements of this plant are being made which will require 200,000 additional horse-power, and still another 150,000 horse-power has been reserved for future developments. This company has an investment of $27,000,000.

The cyanamid process has been adopted in many of the countries of Europe, there being three factories in Germany, two in Norway, two in Sweden, one in France, one in Switzerland, two in Italy, and one in Austria; one also in Japan. There is none in the United States, but there is one in Ontario, utilizing part of the power produced from Niagara Falls. The company owning and operating this factory is the American Cyanamid Company, which began operations in 1909 with a capacity of 12,000 tons per annum. In 1912 this was increased to 32,000 tons, and extensions completed in April, 1914, brought it up to 64,000 tons. In value, the output increased from $540,000 in 1912 to $925,000 in 1913, and to $1,600,000 in 1914. Expansion of this typically modern industry has been going on abroad with equal or even greater rapidity. The total capacity of the plant already established represents an output of $15,000,000 per annum, and an English company is said to be contemplating the application of 1,000,000 continuous horse-power to the production of cyanamid and its derivatives, 600,000 of which has been secured in Norway and 400,000 in Iceland. In the works at Niagara Falls, 25,000 horse-power is used, which is supplied by the Ontario Power Company, and the limestone required is obtained from quarries near Beachville.

The cyanamid product is sold for its content of ammonia, as determined by analysis of samples from each shipment; the analysis usually showing 20 to 22 per cent. of ammonia. It is sold to fertilizer manufacturers and mixers in Canada and the United States for the production of high-grade or "complete" fertilizers. The price per unit fluctuates in sympathy with the cost of other ammoniated materials, such as nitrate of soda, sulphate of ammonia, animal tankage, dried blood, cottonseed meal, etc. During the past two years the price has averaged about $2.25 per unit of ammonia (20 pounds), f.o.b., Niagara Falls, Ont.

The population of the United States grew in the ten years following 1900 from 76 to 92 millions, an increase of 21 per cent., while its crop production during the same period increased only 10 per cent. The proportion of foodstuffs produced which is exported from that country is rapidly declining, and this is true also of animals and meat. The cost of living during the 10-year period went up 59 per cent. Such facts bring into relief the pressing necessity for increasing the productiveness of the soil, and this necessity confronts not the people of the United States only but of Canada as well, and of Ontario as the leading Province of the Dominion. The use of fertilizers is essential to the production of a more abundant food supply, and the foregoing paragraphs are for the purpose of pointing out that with regard to the three indispensable requisites of fertilization, one of them, nitrogen, is already available from a source within the Province itself, and that the raw materials from which the other two may be drawn are within the gift of the mining industry, awaiting only in the case of potash, proof that an efficient and economical process of production is available.

Sources and Uses of Molybdenum

In March, 1915, there was received from the Imperial Institute, London, Eng., a circular letter on the "Sources and Uses of Molybdenum Ores," the object of which was to call attention to the demand now existing for molybdenite in the United Kingdom. The Director of the Institute intimated that he would be glad to have the names and addresses of any firms in Ontario producing this mineral who wished to com-

municate with possible buyers in Great Britain; also to receive samples of molybdenite from localities in which supplies are available, not already represented in the Institute's collections. Such samples would be placed on exhibition in the public galleries of the Imperial Institute, and the attention of inquirers would be directed to them.

The memorandum accompanying the Director's letter deals with the sources of supply of molybdenite within the British Empire, showing it to be widely, though sparingly, distributed, and to occur in the following British countries and possessions: England, Scotland, Australia, New Zealand, Canada, Newfoundland, South Africa, India, Ceylon, the Federated Malay States, and the Virgin Islands of the West Indies. It is also found in the following foreign countries: Austria, France, Germany, Russia, Norway, Sweden, the United States, Japan and Mexico.

The principal production so far has been from Australia, mostly from Queensland. New South Wales also raises considerable ore. The total output from these two States in 1912 was 158 tons, 17 cwt., valued at £21,055, and in 1913 135 tons, 18 cwt., worth £22,987. The occurrences in other parts of the Empire do not seem to have been largely developed and up to the present time have been unimportant as sources of production.

The following extract from the memorandum explains the uses of molybdenite and the causes of the present urgent demand, which has sent the price up to the unprecedented figure of £585 per long ton. From other sources it is learned that as high a figure as $3,600 per ton of 2,000 pounds has been paid.

At the present time there is an exceptionally large demand for "steel hardeners." Two of the chief materials employed for this purpose are molybdenum and tungsten. Before the outbreak of war, Sheffield was largely dependent on Germany for its supply of the latter metal in the proper condition for making "high-speed" steel. This was mainly because British manufacturers were not conversant with the best methods of extracting the metal and preparing it in the proper condition; now, however, they have largely solved the problem, and the metal is being produced in this country.

It is probable that this is only the beginning of a movement for the manufacture of similar metals in the United Kingdom.

The great demand for the so-called "special steels" has increased the demand not only for tungsten, but also for molybdenum, and early in December, 1914, molybdenite ore, containing the equivalent of 90 per cent. molybdic acid, was quoted at £6, 10s. per unit per cent., or £585 per ton of 2,240 lbs.

The widespread use of molybdenum has hitherto been hindered by the irregularity in the supplies of ore and the consequent high cost. The principal hindrance to the exploitation of known deposits has been the lack of satisfactory methods for concentration. A standard ore should contain a minimum of 85 per cent. of molybdenite (molybdenum sulphide, MoS_2). American buyers are stated to require concentrates containing 90 to 95 per cent. of molybdenite, MoS_2. The presence of copper, arsenic, bismuth, or tungsten reduces the price of the ore.

Uses of Molybdenum

The addition of molybdenum to steel increases the hardness, toughness and elongation of the metal. Molybdenum high-speed steel, as used for machine tools, contains 8 to 10 per cent. of molybdenum, and is extremely hard and will retain its cutting properties even when raised to a high temperature.

The compounds of the metal are also used in scientific work, and as pigments in various arts and industries. The ammonium salt of molybdic acid is largely used in steel works and other laboratories as a re-agent for the estimation of phosphorus in steel, soils, etc. Large quantities of molybdenum are consumed in this way. Molybdenum compounds are also used for the production of a yellow colour on porcelain.

It may be added that molybdenum is now coming into use in the manufacture of filaments, etc., for electric lamps.

In this Province molybdenite has been found in Renfrew, Peterborough, Victoria and Hastings counties; Haliburton district, Timagami Forest Reserve, Lake of the Woods area and elsewhere. Small quantities have, at various times, been produced. It is characteristic of this mineral that its occurrences are irregular and pockety. It occurs in hexagonal crystals of flattish pyramidal form, and is also disseminated in

small particles throughout the rock, in which case there is more or less difficulty in separating the mineral from the gangue. Owners of deposits might do themselves and the Empire much service by vigorously exploiting their lands as soon as possible, and in case of their being able to market even small parcels of molybdenite, by communicating with the Director of the Imperial Institute.

Mining Revenue

From mining sources the revenue of the Department for the fiscal year ending 31st October, 1914, was $503,668.55, being $117,724.42 less than in the previous year. Following are the items, together with the corresponding receipts for 1912-13:—

	1913-14.	1912-13.
Sales of mining land	$41,027 50	$95,068 94
Rental, leases, etc.	16,469 76	20,878 43
Miners' licenses, permits, fees	64,195 26	93,256 10
Royalties	74,685 11	200,333 01
Mining Tax Act	306,861 40	211,063 84
Provincial Assay Office, etc.	429 52	404 75
Diamond drills	....	387 90
	$503,668 55	$621,392 97

The following schedule shows the transactions in mining land for the year. It will be noted that the figures do not quite correspond with those given in the summary, since they cover sales, leases, etc., completed during the year, while the summary takes in all moneys collected.

Mining Lands Sold and Leased for year ending October 31st, 1914

District.	Sales.			Leases.			Total.		
	No.	Acres.	Amount.	No.	Acres.	Amount.	No.	Acres.	Amount.
			$			$			$
Timiskaming	294	10.692.49	27.581 05	110	3,837.84	3.837 84	404	14.530.33	31.418 89
Nipissing	6	243.75	732 00	4	127.70	127 70	10	371.45	859 70
Sudbury	8	430.80	1,219 88	7	292.32	292 32	15	723.12	1.512 20
Algoma	39	1,568.51	4,100 37	......	....	....	39	1,568.51	4.100 37
Thunder Bay	83	2,984.84	7,016 16	33	1,420.00	1,420 00	116	4,404.84	8,436 16
Kenora	21	1.005.64	2,041 10	......	....	....	21	1,005.64	2,041 10
Elsewhere	9	457.50	1.072 75	3	159.75	159 75	12	617.25	1,232 50
Total	460	17.383.53	43,763 31	157	5.837.61	5,837 61	617	23,221.14	49,600 92

Miner's Licenses

For miners' licenses and other fees connected with the recording or mining claims, the total receipts were $64,195.26. The fluctuations of this item from year to year indicate the degree of activity in prospecting and speculation in mining lands. When important discoveries are made, many miner's licenses are taken out and many claims recorded by prospectors who rush to the scene of the discoveries. On the excitement subsiding the demand for licenses declines, and the revenue from this source falls until another rich deposit is located. For a number of years, prospecting was very active in the Timagami Forest Reserve, where a fee of $10 is charged to search for mineral, in addition to the ordinary fee of $5 for a miners' license. The reason of the extra charge is that additional fire patrols are required to protect the forests from the danger caused by the presence of mining prospectors. The extent to which prospecting has fallen off in the Reserve may be gathered from the fact that while 629 permits were issued in 1910-11, only 78 were issued last fiscal year.

Royalties

Several of the mines at Cobalt pay a royalty to the Crown on their production. The principal are the O'Brien and Hudson Bay, under special agreement with the Government, and the Crown Reserve, under the terms of the original grant. Details as to the rates, etc., were given in the Twentieth and Twenty-second Reports of the Bureau, at pages 47 and 51 respectively. The payments for the last fiscal year amounted to $74,685.11, as follows:

O'Brien	$5,898 22
Crown Reserve	66,241 75
Hudson Bay	2,545 14
Total	$74,685 11

The total royalties paid by the mines subject to these arrangements, up to the end of the year was $1,836,049.84, as per the following statement:—

Crown Reserve	$771,883 44
O'Brien	700,966 07
Hudson Bay	326,806 35
Chambers-Ferland	26,259 64
Cobalt Provincial	6,735 14
Hargrave	1,200 00
Waldman	777 48
Wyandoh	1,421 72
Total	$1,836,049 84

Some of the mines paying royalty have ceased operation, and the yield of others is declining. It follows, therefore, that this source of revenue will show a decided decrease for the future.

In addition to the above, there are certain mining companies at Cobalt who hold their lands from the Timiskaming and Northern Ontario Railway Commission, and pay the Commission a royalty on their output. These lands, with the mining rights, were vested in the Commission by the Government of the Province chiefly in connection with the station grounds and right of way requirements. At the outset, the leases from the Commission exacted 25 per cent. royalty at the collar of the shaft; this rate was afterwards reduced to 25 per cent. on net profits computed on the basis of the Mining Tax Act. Further reductions were made to 20, 17, 15, 12½ and 10 per cent. On 1st July, 1914, the rate was again reduced, this time to 7½ per cent., at which figure it will stand until 1st September, 1915, when it will come down to 5 per cent. on net profits. The receipts by the Commission for royalties up to 31st October, 1914, were as follows:—

Cobalt Townsite	$279,482 72
City of Cobalt	100,791 13
Right of Way	272,109 17
Nancy Helen	6,126 60
Mining Corporation of Canada	8,405 60
Total	$666,915 22

The Mining Tax Act

The Mining Tax Act (chapter 26, R.S.O. 1914) formerly called the Supplementary Revenue Act, 1907, imposes a tax of 3 per cent. on the net profits of all mines in Ontario in excess of $10,000 per annum, the profits being ascertained as provided in the Act. In the case of mines paying royalties, the tax is not collected. The Act also levies a tax of two cents per acre on mining lands in the unorganized districts, and a tax of two cents per thousand cubic feet on the output of natural gas wells; of the latter, 90 per cent. is rebated when the gas is used in Canada. As there is no gas now piped across the boundary line, the rate collected on the entire production of natural gas is two-tenths of a cent per thousand cubic feet. Where there is gross and deliberate waste of gas, the provisions of the Act are found useful in putting a stop to this reprehensible practice.

The amount received during the last fiscal year under the Mining Tax Act was $306,861.40, as follows:—

Acreage Tax	$ 10,046 41
Profit Tax	272,610 89
Gas Tax	24,204 10
Total	$306,861 40

The 3 per cent tax on profits of mining companies has yielded in all since 1907, when the measure came into force, the sum of $1,075,273.88, the levy by (calendar) years being as follows:—

1907	$ 66,741 68
1908	65,922 48
1909	78,327 58
1910	111,546 17
1911	131,577 75
1912	200,275 25
1913	206,212 77
1914	201,940 20
Total	$1,062,543 88

The mines which have paid the tax, and the amounts paid by each are as follows:

Silver Mines.

Beaver	$ 9,732 90
Buffalo	35,450 65
Casey-Cobalt	4,141 28
Coniagas	103,042 81
Cobalt Silver Queen	4,657 15
Cobalt Comet	1,003 20
Cobalt Lake	9,733 77
Drummond	11,788 84
Foster	577 87
Kerr Lake	109,652 31
La Rose	132,175 48
McKinley-Darragh-Savage	74,380 21
Miller Lake-O'Brien	4,322 04
Nipissing	219,415 87

Timiskaming	$34,052 27
Trethewey	15,153 18
Seneca-Superior	7,339 48
Standard	1,447 00
Watts	258 69
Wettlaufer-Lorrain	19,054 45
Total	$797,379 45

Nickel-Copper Mines

Canadian Copper Company	$205,000 00
Mond Nickel Company	14,226 94
Total	$219,226 94

Gold Mines

Dome	$ 8,278 87
Hollinger	34,451 10
Porcupine-Crown	1,307 80
Total	$44,037 77

Miscellaneous

Lake Superior Corporation (iron)	$1,683 51
Loughborough Mining Company (mica)	216 21
Total	$1,899 72

Summary

Silver Mines	$797,379 45
Nickel-Copper Mines	219,226 94
Gold Mines	44,037 77
Miscellaneous Mines	1,683 51
Total	$1,062,543 88

As regards the Cobalt silver mines only, the above figures show they have paid into the treasury of the Province the sum of $3,300,364.51, without taking into account the amounts contributed to the local municipalities under the provisions of the Mining Tax Act as explained below. The amount is made up as follows:

Royalties paid direct to Crown	$1,836,049 84
Royalties paid T. & N. O. Railway Commission	666,915 22
Three per cent. tax on profits	797,399 45
Total	$3,300,364 51

This contribution from the bounty of nature towards the public expenses of the Province does not appear to have seriously weakened the ability of the producing mines to pay substantial dividends to their shareholders, since as is shown by Table No. VII on page 18 these have reached a total of $55,228,964.42, almost exactly half the gross value of all the silver yet produced from the mines of Cobalt.

In dealing with the revenue from mine taxation, it should be pointed out that by virtue of the Assessment Act of Ontario (R.S.O., 1914, chapter 195), the annual income of a mining company may be assessed for taxation purposes by the municipality within whose bounds it is situated. The Mining Tax Act provides that local taxes paid in pursuance of these provisions may be deducted from the amount accruing under the 3 per cent. clause, to the extent of not more than one-third of the total accrual, or, in the case of the town of Cobalt, not more than one-half. In actual practice, the local municipalities take the necessary steps to secure their full share of the taxation; and it is due to the funds thus provided that so excellent a system of roads has been constructed over the rugged surface of Coleman township, and that such mining towns as Cobalt and Timmins have been enabled to instal water supply, sanitary systems and other ameliorations in keeping with standards of modern civilization.

It may be added, too, that of the acreage tax paid by owners of mining lands in unorganized districts one-half the amount collected in any school section is paid over to the trustees for school purposes.

Mr. George R. Mickle, who, as Mine Assessor, has charge of the collection of revenue arising under the Mining Tax Act, supplies the following notes regarding the operation of the Act for 1913-14.

The levy on profits, the most important source of revenue under the Mining Tax Act, has increased substantially every year till 1912. The last three years have yielded practically the same amount, but the future will show a decided drop, due to the decline in profits of the operations at Cobalt; this being attributable to decreased production in silver, lower price obtained for the metal, and relatively smaller amounts of rich ore. The revenue from the Porcupine district will partially compensate for this.

The tax obtained from natural gas is almost the same as for the previous year. No substantial change in this seems probable during the next few years.

The acreage tax fluctuates greatly. When a list of lands is advertised for forfeiture the returns increase rapidly, the amount received being swelled by the ten per cent. penalty exacted on overdue taxes.

The acreage tax has been in operation for eight years, and the changes that have occurred during that time might well be considered. Two circumstances diminish the number of taxable acres: (1) organization of new municipalities, which renders the lands taxable by the municipality and not by the Province. This arises from increase in the stable or permanent population and is a favourable sign, and (2) the forfeiture of lands for non-payment of taxes. This latter cause has removed approximately 155,000 acres from the tax roll. The increase in taxable lands arises solely from patenting or leasing new lands. In 1909 the total number of acres taxable was 833,812; the distribution of this is given on page 42 of the 18th Report of the Bureau of Mines. The taxable lands are given according to the judicial districts in which they are situated; as the boundaries of these have been materially altered there would be no object in reproducing that statement for comparison. At the present time the total number of acres taxable in the Province is 734,523, and the distribution is as follows:

Kenora District	64,722
Rainy River District	67,252
Thunder Bay District	309,868
Algoma District	113,537
Sudbury District	68,851
Timiskaming District	94,470
Nipissing District	8,897
Parry Sound District	6,925
Total	734,523

In the statement above referred to, i.e., for 1909, Rainy River district included Kenora, and Nipissing included Timiskaming. It will thus be seen that there is a net decrease of approximately 100,000 taxable acres, in spite of the increase in Timiskaming of about 80,000 acres.

Mining Companies

The list of companies incorporated in 1914 under the laws of Ontario to carry on the business of mining in any or all of its branches was much smaller than usual. The number of incorporations was 80, and the aggregate capital authorized $39,030,000. In 1913 the number was 119, with a nominal capitalization of $78,000,000. Besides these, 13 companies of foreign corporation were licensed to do business in the Province, their total capital authorized for use here amounting to $5,445,000.

The lists are as follows:

Mining Companies Incorporated in 1914

Name of Company.	Address.	Date of Incorporation.	Capital.
Anglo Canadian Oils, Limited	Toronto	July 4	$100,000
Bowlby Sand, Lime, Brick Company, Limited	Milton	April 20	100,000
Boyd Pressed Brick Company of Milton, Limited	Milton	January 10	200,000
Buck Lake Mining Company, Limited	Kingston	July 3	50,000
Builders' Cement Tiles, Limited	Hamilton	June 29	40,000
Canadian American Graphite Company, Limited	Prescott	September 19	250,000
Cart Lake Cobalt Silver Mines, Limited	Toronto	May 8	2,000,000
Chippewa Development Company, Limited	Chippawa	June 18	40,000
Clausman Mines, Limited	Toronto	July 6	1,500,000
Coomac Oil Fields, Limited	Toronto	June 9	3,000,000
Creosoted Block Paving Company, Limited (Clay Products)	Toronto	October 21	100,000
Frontenac Mica Company, Limited	Sydenham	February 7	50,000
Gerard Mines, Limited	Ottawa	May 2	1,000,000
Germerica Mining Company, Limited	Windsor	October 2	650,000
Gilmour Lime and Gravel Company, Limited	Toronto	November 4	75,000
Glen Lake Cobalt Mines, Limited	Toronto	July 9	1,000,000
Great Western Exploration Company, Limited	Toronto	May 20	100,000
Hamilton Gas and Oil, Limited	Hamilton	April 24	40,000
Hamilton Sand and Gravel, Limited	Hamilton	February 17	80,000
Hope Manufacturing Company, Limited (Sewer Pipe, etc.)	Toronto	March 2	40,000
Hunton-Kirkland Gold Mines, Limited	Haileybury	January 30	1,500,000
James Devonshire, Limited (Clay Products)	Toronto	March 18	40,000
Lake Shore Mines, Limited	Haileybury	February 25	1,500,000
Lake Shore Sand and Gravel Company, Limited	Toronto	February 28	250,000
Laurabel Silver Mines, Limited	Toronto	March 18	1,000,000
Little River Brick & Tile Company, Limited	Windsor	January 19	100,000
Minaker-Kirkland Gold Mines, Limited	Haileybury	January 15	1,500,000
Montgomery Crawford Mining Company, Limited	New Liskeard	July 2	400,000
National Copper Company, Limited	Toronto	July 4	1,000,000
New Extension Mines, Limited	Toronto	July 14	100,000
Niagara Dredging, Limited	St. Catharines	December 8	40,000
North-Woods Mines, Limited	Toronto	February 13	40,000
Northeast Kirkland Mining and Development Co., Limited	Toronto	March 28	750,000
Northern Trap Rock Company, Limited	Toronto	June 8	1,000,000
Nuca Oil Company, Limited	Ottawa	July 31	750,000
Ontario Rand, Limited	Toronto	January 2	1,500,000
Ontario Sand Company, Limited	Niagara Falls	February 21	45,000
Ore Mountain Mines, Limited	Hamilton	March 28	1,000,000
Pay Ore Mines, Limited	Hamilton	March 27	500,000
Porcupine Pet Gold Mines, Limited	Toronto	April 7	1,000,000
Porcupine Porphyry Hill Gold Mines, Limited	Toronto	April 7	1,000,000
Porcupine Vipond Mines, Limited	Toronto	April 24	1,500,000
Port Sidney Land and Mining Company, Limited	Toronto	January 28	100,000
Preston Oil & Gas Company, Limited	Preston	November 26	250,000
Refractory Ore Converters, Limited	Hamilton	February 14	150,000
Rocsand Co., Limited	Hamilton	June 24	100,000
Royal Metals Separator Company, Limited	Kenora	February 3	100,000
St. David's Sand Company, Limited	St. Catharines	August 17	50,000
Schumacher Gold Mines, Limited	Toronto	January 16	2,000,000
The Alvinston Brick and Tile Company, Limited	Alvinston	March 27	40,000
The Antonio Silver Mines, Limited	Toronto	March 2	1,500,000
The Atikokan Development Company, Limited	Fort Frances	March 12	40,000
The Attercliffe Standard Brick, Block and Tile Company, Limited	Attercliffe Sta.	August 5	40,000
The Azoff Natural Gas Company, Limited	Canfield	March 20	40,000
The Barton Sand and Gravel Company, Limited	Hamilton	October 20	100,000
The Buff Pressed Brick Company of Hamilton, Limited	Hamilton	January 27	40,000
The Canadian Peat Company, Limited	Toronto	February 12	250,000
The Canadian Sand and Gravel Company, Limited	Thorold	May 6	100,000
The Canadian Sewer Pipe and Clay Product Co., Limited	Hamilton	January 16	150,000
The Cataract Junction Sand and Gravel Company, Limited	Toronto	March 21	50,000
The Clifton Sand and Gravel Corporation, Limited	Toronto	September 18	150,000
The Dominion Clay Products Company, Limited	Toronto	April 29	350,000
The Kingston Construction Company, Limited	Kingston	March 18	50,000
The Lally Gold Mines, Limited	Toronto	January 6	3,000,000
The Lethbridge Brick Company, Limited	Steelton	June 2	30,000
The Mineral Springs Sand & Gravel Company, Limited	Hamilton	February 28	40,000

Mining Companies Incorporated in 1914.—Continued

Name of Company	Address	Date of Incorporation	Capital
The Oil and Gas Development Syndicate, Limited	Hamilton	May 22	40,000
The Oliver Rogers Stone Company, Limited	Owen Sound	February 5	60,000
The Standard Smelting and Refining Company, Limited	North Bay	February 14	150,000
The Stewarttown Quarries, Limited	Milton	July 8	80,000
The Stoness Anglin Gilbert Mica Mining Co., Limited	Kingston	February 5	90,000
The Tierney Construction Company, Limited	Ottawa	March 16	100,000
The Tri-State Oil and Gas Company, Limited	Toronto	June 1	1,000,000
The Union Cement Company, Limited	Owen Sound	May 12	200,000
The White Reserve Mining Co., Limited	Toronto	June 17	200,000
Toronto Sand and Gravel Company, Limited	Toronto	March 25	50,000
Vacuum Gas and Oil Syndicate, Limited	Toronto	August 17	60,000
Victoria Iron Ore Company, Limited	Toronto	January 27	100,000
West Lake Brick and Products Company, Limited	Wellington	October 20	250,000
Western Ontario Natural Gas Company, Limited	Brantford	June 22	1,000,000
		Total	$39,030,000

Mining Companies Licensed in 1914

Name of Company.	Head Office for Ontario.	Date of License.	Capital for use in Ontario.
Burnside Gold Mines, Limited	Haileybury	March 27	£400,000
Calgary-Alberta Oils, Limited	Toronto	October 5	$ 40,000
Cobalt Porcupine Syndicate, Limited	Ottawa	July 2	500,000
Crystal Oil Company, Limited	Toronto	September 18	40,000
Interprovincial Brick Company of Canada, Limited	Toronto	April 12	275,000
Kirkland-Goldfields, Limited	Haileybury	August 17	50,000
Kirkland Lake Proprietary, Limited	Toronto	November 11	40,000
Teck-Lebel (Kirkland) Syndicate, Limited	Toronto	May 14	£10,000
The Anglo-French Exploration Company, Limited	Toronto	July 9	$200,000
The Consolidated Stone Company, Limited	Toronto	January 13	10,000
The Huronian Belt Company, Limited	Almonte	June 6	£25,000
The Mining Corporation of Canada, Limited	Toronto	March 20	$2,075,000
Vitrified Clays, Limited	Toronto	December 17	40,000

Mining Divisions

Following is a list of the Mining Divisions of Ontario, showing also the names and addresses of the Mining Recorders and the receipts from each Division for the last fiscal year:

Mining Division.	Name and P.O. Address of Recorder.	Receipts.				Total Receipts.
		Purchase Money.	Miner's Licenses.	Permits.	Recording Fees.	
		$	$	$	$	$
Kenora	W. L. Spry, Kenora	1,472 10	384 00	....	429 50	2,285 60
Port Arthur	J. W. Morgan, Port Arthur	6,803 80	2,618 00	90 00	4,003 25	13,515 05
Sault St. Marie	S. T. Bowker, Sault Ste. Marie	4,107 03	896 00	....	468 00	5,471 03
Sudbury	C. A. Campbell, Sudbury	2,707 96	3,302 00	140 00	3,905 25	10,055 21
Gowganda	H. E. Sheppard, Gowganda	1,868 07	979 00	120 00	512 06	3,479 13
Montreal River	A. Skill, Elk Lake	2,275 79	646 00	40 00	532 75	3,494 54
Timiskaming (including Coleman)	G. T. Smith, Haileybury	1,401 86	7,310 00	10 00	2,721 40	11,443 26
Parry Sound	H. F. McQuire, Parry Sound	300 00	141 00	....	41 00	482 00
Larder Lake	J. A. Hough, Matheson	6,696 04	1,996 00	....	10,575 75	19,267 79
Porcupine	G. H. Gauthier, Porcupine	14,700 20	3,263 00	270 00	5,418 25	23,651 45
	Total	42,332 85	21,535 00	670 00	28,607 21	93,145 06

For Eastern Ontario and the Fort Frances Mining Division no resident Mining Recorder has yet been found necessary, and in accordance with the provisions of the Mining Act all mining claims are recorded and other business regarding mining lands transacted with the Department at Toronto. The revenue not derived through the Mining Recorders' offices is collected by the Department.

Brief reports are made by the Recorders on the work done in their several Divisions during the year. These are summarized as follows:

Kenora

Miner's licenses issued, 28; Miner's licenses renewed, 47; claims filed, 25; transfers, 6; certificates of record, 20; certificates of work, 23; appeals to Mining Commissioner, 1; letters received, 957; letters written, 826.

Port Arthur

Letters received, 2,303; letters written, 2,270; miner's licenses issued, 239; miner's licenses renewed, 284; mining claims recorded, 353; mining claims cancelled, 115; transfers and agreements filed, 153; surveyor's plans and field notes filed, 74 sets; applications for patents or leases, 72; certificates of record granted, 34; certificates of work, 27.

Gold was discovered north of Schreiber and nickel was reported found northeast of the Nipigon Forest reserve.

Sault Ste. Marie

Miner's licenses issued, 56; miner's licenses renewed, 125; mining claims recorded, 23; mining claims cancelled, 68; mining claims transferred, 20.

Sudbury

Miner's licenses issued, 177; miner's licenses renewed, 461; mining claims recorded, 237; mining claims cancelled, 2,088; transfers, agreements, etc., filed, 230.

There were more or less prospecting in West Shiningtree, Berth 11, and Davis township; also later in the year in Olrig township, where rare minerals are said to have been found.

Montreal River

Miner's licenses issued, 120; miner's licenses renewed, 9; certificates of record issued, 17; certificates of work, 20; mining claims recorded, 28; Forest Reserve permits issued, 2.

There was little activity last year. Work was done with good promise on the White Reserve and Rubicon mines in Whitson township, Maple Mountain area; also on the Mapes-Johnston property in the township of Mickle.

Gowganda

Miner's licenses issued, 14; miner's licenses renewed, 129; certificates of record issued, 42; certificates of work, 51; mining claims recorded, 23; mining claims cancelled, 1,072; transfers and agreements recorded, 19; Forest Reserve permits issued, 13.

A locally important feature was the finding of good ore bodies on the Miller Lake-O'Brien properties and the persistence there in value of known veins to a depth of over 400 feet. The Clevenger Mining Company on the Mann ridge have worked steadily with encouraging results, but the Mann and two other companies operating with old-country capital have suspended work. The money stringency has put a stop to speculative enterprise.

Timiskaming and Coleman

Miner's licenses issued, 294; mining licenses renewed, 1,215; Forest Reserve permits issued, 5; transfers, agreements, etc., filed, 99; mining claims recorded, 215; mining claims cancelled, 217; certificates of record and work granted, 31; disputes entered, 2; appeals, 1; applications for patents, 16; extensions of time, 60.

Prospectors and others holding mining claims on which the work had been done found it difficult to get the money to take out patents. In the early part of the season many claims were staked out in the townships of Lee, Bompas, Block, Alma and Cairo, but few of them were recorded, prospectors being short of funds. In nearly all

cases discovery of gold-bearing quartz was reported. Many prospectors living and usually operating in Timiskaming were attracted to Larder Lake division by the gold finds in some of the townships now included in that division.

Larder Lake

Miner's licenses issued, 120; miner's licenses renewed, 421; claims recorded, 718.

Parry Sound

Miner's licenses issued, 6; miner's licenses renewed, 22; claims recorded, 2; claims cancelled, 11; certificates of record issued, 1; certificates of work, 1.

There was little prospecting during the year, owing to the scarcity of money and the restrictions placed by the law on located and patented lands. Some 20 or 25 iron ore claims staked out in the township of Lount are still under development.

Porcupine

Miner's licenses issued, 134; miner's licenses renewed, 493; claims recorded, 240; claims cancelled, 3,270; transfers recorded, 232; agreements, 7; disputes entered, 11; Forest Reserve permits issued, 9.

There was a marked falling-off in business as compared with last year. Prospecting naturally diminishes as a camp becomes older, but the financial stringency, especially after the war broke out, had a great effect in lessening activity. Considerable development work was nevertheless done on promising prospects, and four mines were added to the list of producers, namely, Porcupine Crown, Vipond, Rea and Little Pet. In the proven area and working mines, the prospects are exceedingly bright, and the importance of the camp has been fully established. Several of the mines are adding to their milling capacity, and the production of gold in 1915 will probably be not less than six million dollars.

Provincial Assay Office

Mr. W. K. McNeill, B.Sc., in charge of the Provincial Assay Office, Toronto, reports as follows for the year 1914:

During the past year work has been carried on much along the same general lines as in former years. Nearly six hundred samples were examined and reported upon. In addition a large number were identified, and general information was given for which the Department made no charge.

This year the laboratory was equipped with a Curie electroscope for testing radioactivity, and owing to the encouragement given by the Legislature for the discovery of radium-bearing ores there has been an unusually large number of samples submitted. No charge is made for testing for radium.

During the latter part of the year a renewed interest was created in platinum-bearing ores by the reported finds of the ores in Northern Ontario; consequently a number of samples were sent to us for assay.

The office took charge this year of the mineral exhibit of the Bureau of Mines at the Canadian National Exhibition, Toronto, which was placed in charge of Mr. T. E. Rothwell, Assistant Provincial Assayer. An exceptionally fine display of the mineral resources of the Province was made, the success of which was due in a large measure to the cheerful co-operation of the mining companies and individuals who appreciate the educational value of such an exhibit.

The chemical laboratories and assay office are among the most up-to-date in the Province, and are especially designed and equipped for accurate work; but so as not to encroach on the professional domain of private assayers and testing laboratories, a fee is charged for all public work, the purpose being to have a laboratory to assist prospectors and to do umpire work.

The work consists of:

(*a*) Examination and assaying of samples received from prospectors, mining engineers, geologists and the public generally.

(*b*) Analysis of samples of rocks, etc., for the geologists of the Bureau of Mines.

(*c*) The sampling of carload lots of cobalt silver ores shipped from the mines, upon which the Government collects a royalty. This work is done at the various smelters, and is in charge of Mr. T. E. Rothwell, Assistant Assayer.

(*d*) The assaying and valuation of these car lots.

(*e*) Special research work.

Instructions

Samples will be dealt with in the order of their arrival. In every instance specimens and samples should be accompanied by statement specifying the precise locality whence they were taken.

Crushed samples representing large quantities or samples less than five pounds weight may be sent by mail as third class matter. Write your name and address plainly on each parcel. Send instructions, with money in payment of fees in a separate letter. Samples may be sent by express, charges prepaid.

Sample bags addressed to this Laboratory for sending ore pulp by mail may be obtained free on application; also canvas bags for shipping.

Money in payment of fees, sent in by registered letter, post-office order, postal note, or express order, and made payable to the Provincial Assayer, must invariably accompany sample to insure prompt return of certificate, as no examination is commenced until the regulation fee is paid.

Samples should be addressed as follows:

To

Provincial Assay Office,

5 Queen's Park,

Toronto, Ont.

Schedule of Charges

1. *Assays*:

Gold	$1 00
Silver	1 00
Gold and Silver in one sample	1 50
Platinum	4 00
Gold and Platinum in one sample	5 00
Gold by amalgamation	2 00

For the amalgamation assay for gold at least five pounds of ore must be sent.

2. *Iron Ores*:

Iron (metallic)	$1 00
Silica	1 50
Iron and insoluble residue	1 50
Ferrous Oxide	2 00
Phosphorus	2 00
Sulphur	2 00
Iron, Sulphur, Phosphorus and insoluble	5 00

Manganese	$2 00
Titanium	2 00
Complete analysis:—Ferrous Oxide, Ferric Oxide, total Metallic Iron, Silica, Alumina, Lime, Magnesia, Manganese, Phosphorus, Sulphur and Titanium	15 00

3. *Limestones, Dolomites, Marls, Clays, Shales*:

Determination of:

Insolubles	$1 00
Silica	1 50
Ferric Iron	2 00
Ferrous Iron	2 00
Alumina	2 00
Lime	1 50
Magnesia	1 50
Alkalies (combined)	5 00
Potash	4 00
Water (combined)	1 00
Moisture	0 50
Organic Matter	1 00
Carbon Dioxide	1 50
Sulphur	2 00
Phosphorus Anhydride	2 00

4. *Examination of Clay, Shale, or Cement Rock for Cement Manufacture*:

Determination of:

Silica, Iron Oxide, Alumina, Lime, Magnesia, Sulphuric Anhydride and Volatile Matter	$10 00

5. *Coal, Coke, Peat, etc.*

Determination of:

Moisture	$0 50
Volatile Combustible	1 00
Fixed Carbon	1 00
Ash	1 00
Sulphur	2 00
Phosphorus	2 00
Calorific Value	5 00
Ultimate Analysis	Price on Application

6. *Mineral Waters* .... Price on Application

7. *Ores and Minerals*:

Determination of:

Alumina	$2 00
Antimony	3 00
Arsenic	3 00
Bismuth	3 00

Cadmium	$3 00
Chromium	3 00
Cobalt	3 00
Copper	2 00
Gold	1 00
Ferrous Oxide	2 00
Ferric Oxide	2 00
Lead	2 00
Lime	1 50
Magnesia	1 50
Molybdenum	2 00
Manganese	2 00
Nickel	3 00
Silica	1 50
Water	1 00
Zinc	2 00

8. *Rocks, Complete Analysis* .... Prices on Application

9. *Slags, Sand, etc.* .... Prices on Application

10. *Identification of Minerals and Rocks not Requiring Chemical Analysis* .... Free

Any analytical work not specified in this circular will be undertaken on application to the Provincial Assayer.

The pulp of each sample is retained for future reference.

MINING ACCIDENTS IN ONTARIO IN 1914

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, E. A. Collins, Kingston; J. G. McMillan, Cobalt; James Bartlett, Sudbury

During the year 1914 at the mines, metallurgical works, quarries, clay pits, and gravel pits regulated by the Mining Act of Ontario there were 54 fatal accidents, causing the death of 58 men. Of these, 28 causing the death of 29 men, occurred underground—a decrease of 8 as compared with the preceding year. The fatal accidents took place in mines operated by 23 different companies. At metallurgical works there was a marked decrease—4 fatal accidents causing the death of 5 men as compared with 11 fatalities during 1913. The number of fatalities at quarries shows an increase—14 fatal accidents resulting in 15 men killed, as compared with 8 killed in 1913, and one in 1912. The increase noted from year to year in the number of fatalities at quarries and clay and gravel pits is due to the fact that more complete returns are now being received from such works than formerly.

The tables of accidents at the metallurgical works and quarries are separated in this Report from accidents at the mines. For this tabulation the clay and gravel pits are grouped under the heading Quarries.

The total number of serious accidents in and about the mines of Ontario reported to the Bureau of Mines in 1914 was 359; resulting in 38 deaths and injuries to 328 persons; of these accidents 282 occurred underground, and 75 above.

At metallurgical works there were 104 accidents, which caused the death of five men and serious injuries to 101.

At quarries there were 30 accidents, causing the death of 15 men and serious injuries to 16. It is evident that only a small portion of the non-fatal accidents at quarries is being reported to this Department.

In accordance with the Mining Act, inquests were held on all fatal accidents and attended by one of the Inspectors.

Table of Accidents

—	1913.		1914.	
	Killed.	Injured.	Killed.	Injured.
Mines:—				
No. killed underground	37	....	29	....
No. " surface	8	....	9	....
No. injured underground	....	251	....	251
No. " surface	....	69	....	77
Metallurgical Works:—				
No. killed	11	....	5	....
No. injured	....	201	....	101
Quarries:—				
No. killed	8	....	15	....
No. injured	....	12	....	16
Totals	64	533	58	445

The fatal accidents occurring in the mines were divided amongst the several districts as follows:

Gold mines of Porcupine and Kirkland lake	12
Silver mines of Cobalt and adjacent districts	11
Nickel-copper mines of Sudbury	9
Iron mines of Michipicoten	4
Iron pyrites mine, Western Ontario	1
Mica mine, Eastern Ontario	1
Total	38

It is interesting to note that the greater number of fatalities occurred during the first six months of this year as in 1912.

Month.	1913.		1914.	
January	10		6	
February	12		5	
March	9		7	
April	6		7	
May	8		5	
June	2		8	
		47		38
July	5		4	
August	6		5	
September	1		2	
October	2		3	
November	2		4	
December	1		2	
		17		20

Analysis of Fatalities at Mines

Cause.	1913	1914
	Per cent.	Per cent.
Falls of ground	11.1	7.9
Shaft accidents	20.0	26.3
Explosives	31.1	26.3
Miscellaneous (underground)	20.0	15.8
Surface	17.8	23.7

Table of Fatal Accidents in Mines, Metallurgical Works and Quarries, 1901 to 1914

—	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Total.
Persons killed at metallurgical works and mines	13	10	7	7	9	11	22	47	49	48	49	43	64	58	437
Persons employed at metallurgical works and producing mines	4,135	4,426	3,499	3,475	4,415	5,017	6,305	7,435	8,505	10,862	12,543	13,108	14,293	14,361	112,379
Persons employed at non-producing mines (estimated)	550	450	400	400	500	750	1,140	1,750	2,000	2,000	2,000	2,000	2,000	1,500	17,440
Total persons employed	4,685	4,876	3,899	3,875	4,915	5,767	7.345	9,185	10,505	12,862	14,543	15,108	16,293	15,861	129,819
Fatal accidents per 1,000 ployed	2.77	2.05	1.79	1.80	1.83	1.90	2.99	5.11	4.66	3.73	3.37	2.84	3.93	3.6	3.37

Cause and Place of Fatalities in Mines

The following schedule shows the cause and place of the fatalities in 1914, compared with 1913:—

	1913.		1914.	
Below ground:—				
Falls of ground	5		3	
		5		3
Shaft accidents:—				
Staging in shaft breaking	0		1	
Falling down shaft	1		2	
Objects falling down shaft	2		2	
Falling from bucket	0		2	
Attempting to get on and off skip or cage in motion	4		1	
Falling crosshead	2		0	
Run over by skip	0		1	
Killed in cage while gassed	0		1	
		9		10
Explosive accidents:—				
Premature explosion while loading or lighting holes	8		5	
Drilling into bottom of old or missed holes	5		1	
Asphyxiation from gases from explosives	1		2	
Picking or putting bar into old hole containing explosive	0		1	
Delayed explosion while sandblasting	0		1	
		14		10
Miscellaneous accidents:—				
Falling down winze	1		2	
Falling down stope	1		1	
Struck or buried by ore	4		2	
Struck by falling objects	2		0	
Crushed between cars	1		0	
Scaling	0		1	
		9		6
Above ground:—				
Crushed by car	1		0	
Struck by falling objects	0		1	
Electrocuted	2		0	
Killed by fall	3		3	
Caught by machinery	2		1	
Team running away	0		1	
Drowned	0		2	
Boiler explosion	0		1	
		8		9
Total		45		38

The occupation and nationality of men killed in or about the mines are set out in the following table:

Occupation.	English Speaking.	Finn.	Italian.	Austrian.	Galician.	Rouman-ian.	German.	Russian.	Total.
Drill runner	4	4	3	2	......	1	......	......	14
Drill helper	2	1	1	......	1	......	1	......	6
Trammer	......	......	1	......	1	......	......	1	3
Blaster	1	......	1	......	......	......	......	......	2
Foreman	3	......	......	......	......	......	......	......	3
Teamster	1	......	......	......	......	......	......	......	1
Timberman	1	1	......	......	......	......	......	......	2
Mechanic	2	......	......	......	......	......	......	......	2
Carpenter	1	......	......	......	......	......	......	......	1
Millman	1	......	......	......	......	......	......	......	1
Labourer	......	1	1	......	......	......	......	......	2
Deckman	1	......	......	......	......	......	......	......	1
Totals	17	7	7	2	2	1	1	1	38

The ages of the men killed at the mines were as follows:—

17–20	21–25	26–30	31–35	36–40	41–45	60–65	Total.
1	9	12	9	4	2	1	38

Cause and Place of Non-Fatal Accidents at Mines

The following schedule shows the cause and place of the non-fatal accidents in 1914 at the mines and the number injured:—

Underground:—

Falls of ground 3

Shaft accidents:—

Cage accidents 12
Falling part way down shaft 10
Objects falling down shaft 6
Miscellaneous 1
—— 29

Explosives:—

Drilling into old or missed holes 8
Picking into explosives 4
Premature explosion 8
—— 20

Miscellaneous accidents:—

Falling down stopes, raises, winzes, chutes or man-ways	8	
Jammed by cars, skips, buckets or pieces of rock or ore	50	
Scaling	15	
Foreign material in eyes	19	
Injured at chutes	21	
Burned	2	
Flying rock	3	
Rock rolling down pile	19	
Caught by drill	21	
Falling objects	16	
Falling from staging	13	
Miscellaneous	12	
		199

Surface:—

Falling from elevated places	2	
Caught by machinery	30	
Burned by electric wire	1	
Falling objects	8	
Burned	2	
Foreign material in eyes	5	
Boiler explosion	1	
Slipped on ice	6	
Miscellaneous	22	
		77
Total		328

The occupation and nationality of the men injured in or about the mines were as given below:—

Occupation	English Speaking.	Finn.	Italian.	Pole.	Swede.	Austrian.	Roumanian.	Spanish.	Hollander.	German	Russian.	Turk.	Galician.	Unknown.	Total.
Drill runner	19	19	12	11	3	7	1	....	....	2	2	1	2	3	82
Drill helper	10	8	5	4	....	3	....	....	....	....	....	....	....	3	33
Trammer	5	4	28	26	2	17	10	2	....	....	12	....	....	3	109
Labourer	3	2	6	3	....	2	....	....	1	....	2	....	....	....	19
Foreman	5	2	2	....	....	....	....	....	....	....	....	....	....	....	9
Machinist	10	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Carpenter	7	2	....	....	....	....	....	....	....	....	....	....	....	....	9
Crusherman	4	....	....	....	....	....	....	....	....	1	1	....	....	....	6
Electrician	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Timberman	7	3	....	....	....	....	....	....	....	....	....	....	....	....	10
Refiner	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Deckman	2	....	....	1	....	....	....	....	....	....	....	....	....	....	3
Blacksmith	6	....	....	....	....	....	1	....	....	....	....	....	....	....	7
Draughtsman	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Millman	11	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Scaler	1	2	1	....	....	....	....	....	....	....	....	....	....	....	4
Engineer	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Pumpman	2	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Cagetender	3	1	1	2	....	....	....	....	....	....	....	....	....	....	7
Hoistman	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1
Blaster	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Totals	99	44	57	47	5	29	12	2	1	3	17	1	2	9	328

The ages of the men injured at the mines were as follows:—

17–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	75–80	Unknown	Total
23	85	96	43	38	12	3	3	1	1	23	328

The following table shows the time during which the injured persons were incapacitated for work.

Class of Work	1 to 2 Weeks	2 to 3 Weeks	3 to 4 Weeks	4 to 5 Weeks	5 to 6 Weeks	6 to 7 Weeks	7 to 8 Weeks	8 to 9 Weeks	9 to 10 Weeks	10 to 12 Weeks	Over 12 Weeks	Not Reported Cured	Totals
Mines—													
Above ground	21	8	3	6	5	7	2	5	1	1	6	12	77
Below ground	62	46	27	21	12	20	6	7	8	9	10	23	251
Metallurgical works..........	27	18	12	6	7	1	4	1	1	4	6	14	101
Quarries.....................	2	1	2	1	....	2	....	....	....	2	1	5	16
Totals	112	73	44	34	24	30	12	13	10	16	23	54	445

Legislation Affecting Mines

On January 1st, 1915, the amendment to the Mining Act affecting cages and skips used for carrying men came into force. It is as follows (section 164, rule 32*a*):—

All cages and skips used for lowering or raising men shall be constructed as follows:

(*a*) The hood shall be made of steel plate not less than three-sixteenths of an inch in thickness;

(*b*) The cage shall be provided with sheet iron or steel side casing not less than one-eighth of an inch in thickness, or with a netting composed of wire not less than one-eighth of an inch in diameter, and with doors made of suitable material;

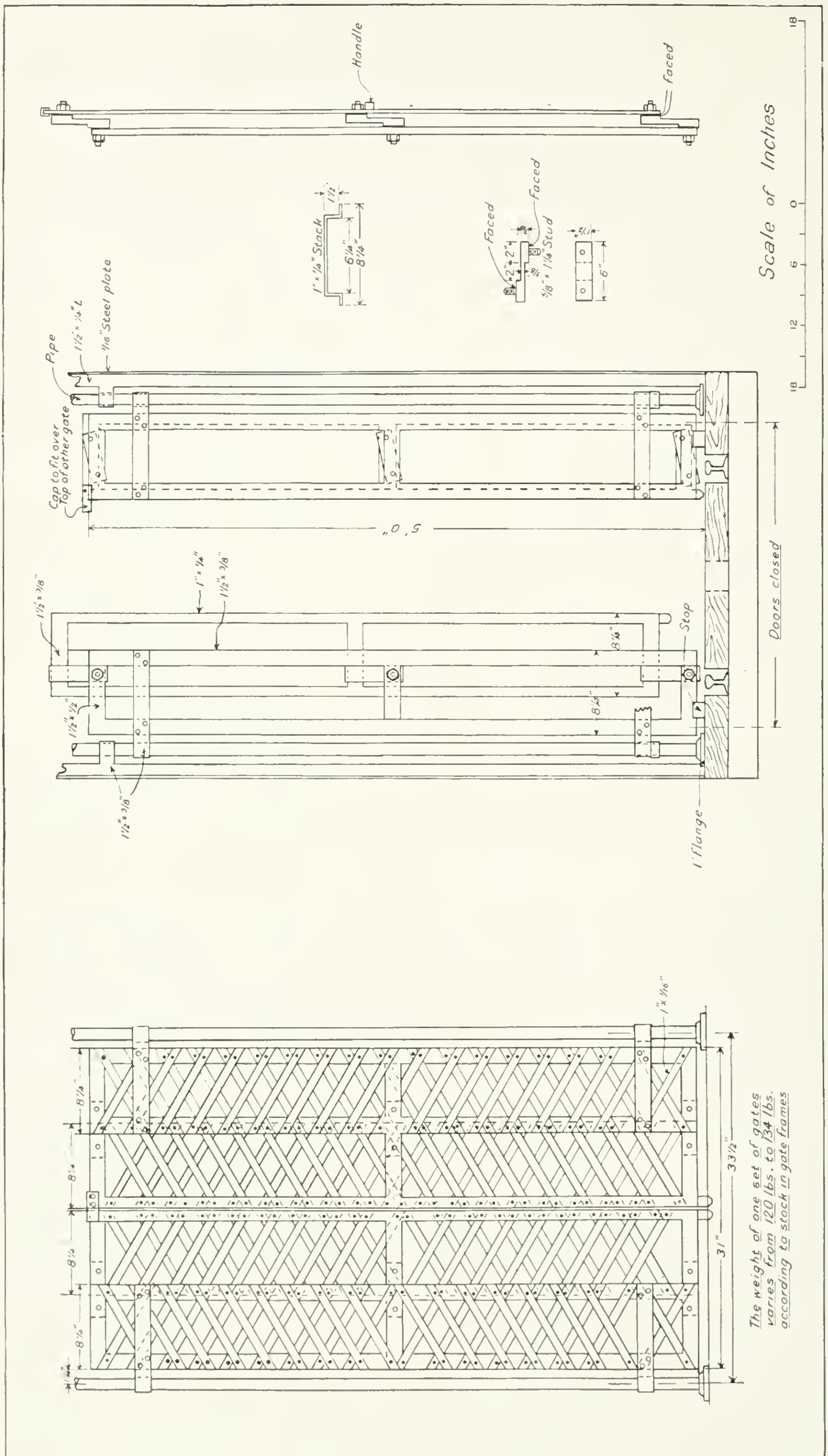
(*c*) The doors shall extend at least five feet above the bottom of the cage, and shall be closed when lowering or hoisting men;

(*d*) The cage shall have overhead bars so arranged as to give every man an eas. and secure handhold;

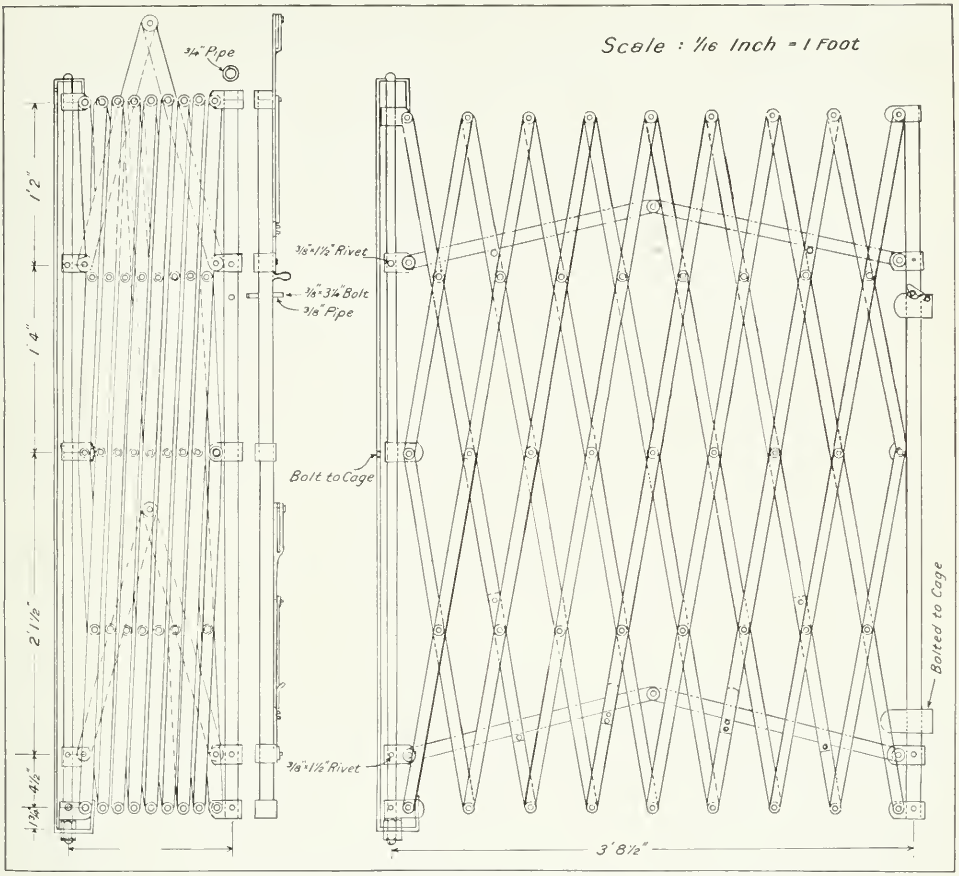
(*e*) The safety appliances shall be of sufficient strength to hold the cage or skip with its maximum load at any point in the shaft.

(*f*) The cage shall not have chairs attached thereto which are operated by a lever through or from the floor.

The necessity for a regulation of this kind is seen from the number of accidents every year due to the light open-type cage in use at many Ontario mines. Care should be taken that the gate is kept in good repair and is so constructed that it cannot open outwards, thus avoiding all possibility of catching in the shaft timbers.



Gates for Mine Cage, Porcupine Crown Mines, Timmins.



Collapsible Cage Gate, Crown Reserve Mine, Cobalt.

On January 1st, 1915, the Workmen's Compensation Act came into force.

The mining industry is included in Schedule I. Industries so classified are not individually liable. The Board levies an assessment and collects an accident fund, out of which the compensation to workmen is paid.

Compensation is paid on all accidents arising out of and in course of the employment, except:—

1. Where the disability lasts less than seven days.

2. Where the accident is attributable solely to the serious and wilful misconduct of the workman and does not result in death or serious disablement.

The scale of compensation is as follows:—

If the accident results in death and the workman leaves a widow but no children, the widow is entitled to a monthly payment of $20 a month.

If he leaves a widow and children the payment to the widow is $20 a month and $5 a month for each child under 16 years of age, not exceeding $40 in all.

If he leaves children only, the payment is $10 a month for each child under 16, not exceeding $40 in all.

If the workman was under 21 years of age and his dependents are his parents or one of them, such parents or parent will be entitled to $20 a month until the workman would have become 21 years of age, or for such longer time as the Board may determine.

In the case of other dependents they are entitled to a sum reasonable and proportionate to the pecuniary loss occasioned to them by the workman's death, as determined by the Board.

The necessary expenses of burial, not exceeding $75, are also in all cases to be paid.

All the above is governed, however, by the provision that in no case is the compensation to exceed 55 per cent. of the workman's earnings in the employment; and all provisions for compensation are subject to the proviso that no salary or wages of a workman shall be reckoned at more than $2,000 a year.

In the case of a widow who marries again the periodical payment ceases on her marriage, but she is entitled within a month after her marriage to a lump sum equal to two years' payments.

Where the accident results in total disability of the workman, he is entitled during the continuance of the disability, whether for life or temporarily, to a weekly or monthly payment equal to 55 per cent. of his earnings in the employment. Where the workman is only partially disabled he is entitled to 55 per cent. of the impairment of his earning capacity.

Where less than six workmen are usually employed in mining, including prospecting and development work, except in producing mines where the workmen are in the employ of the owner, lessee or recorded holder thereof, the industry is withdrawn from its class in Schedule I.

An industrial disease is considered a personal injury by accident, and a workman or his dependents is entitled to the regular scale of compensation. The most common industrial disease in mining is miners' phthisis.

Employers are required to give notice to the Board by registered mail of an accident within three days of its occurrence.

The rate assessed per $100 of payroll in mining and associated industries is as follows:—

Mining	$3 00
Iron smelting	2 00
Concentrating, stamping or other preparations of metals or minerals (without heat)	0 80
Reduction of ores (with heat), smelting or refining of other metals or minerals	1 50
Clay and gravel pits	2 00
Quarries	2 50
Railroads	6 00
Manufacture of explosives	10 00

The Act as it now stands is criticized by mine operators in connection with the following points:—

Miners' phthisis is an industrial disease which, under ordinary conditions in Ontario would result only after several years' work underground. There is nothing in the Act to prevent a miner who has contracted this disease in another country moving to Ontario and taking advantage of the compensation paid by the Ontario Act.

The Act requires that all accidents be reported within three days. All compensation is paid only for accidents which incapacitate a workman for seven days, and as the majority of mining accidents do not disable a man for this period, the reporting of such accidents entails considerable unnecessary work.

The grouping of all the mines under one classification weakens the incentive to avoid accidents. Certain mines are necessarily more unsafe to work than others, and must in the long run have a higher accident rate. Within the past three years several mining companies in Ontario have by means of safety engineers, mine inspectors or safety committees gone to considerable expense in efforts to lower their accident rate; in every case these efforts have met with signal success. Nevertheless the safe mine or the careful operator has to pay the same rate as the unsafe mine or the indifferent operator. The result has been that since the Act came into force several companies have abolished their safety departments.

Falls of Ground

Three men were killed in 1914 as a result of falls of ground, a decrease of two compared with 1913. Few mines in Ontario have what can be called "bad ground."

At the Crown Reserve mine on March 7th J. Johnson, a timberman, was killed while scaling. The piece which fell weighed about four tons and had been examined by Johnson, who considered it safe.

At the Helen mine on May 2nd an Italian drill runner, named Giacinto Zanetti, while mining out a small pillar, was caught and killed by a sudden rush of fine ore when a pocket of loose hematite in the pillar was tapped. It is probable that this pocket of loose ore was formed by the partial crushing of the pillar.

At the same mine on July 2nd an Italian trammer, Dante Boni, was caught and killed by a sudden rush of pyritic mud which was being mined.

Shaft and Winze Accidents

Twelve men were killed in shaft and winze accidents during 1914, an increase of two over the preceding year.

The shaft accident at No. 2 mine of the Canadian Copper Company on June 25th, whereby shift boss Bedford was run over by a skip and instantly killed, was directly due to an infringement of the Mining Act by a Pole trammer named Radul, who acted as skiptender on the tenth level and who signalled from that level for the skip, which was at the ninth. Radul was arrested on a charge of criminal negligence and, not being able to supply bail, was kept in the Sudbury jail until October, when his trial was held. He was found guilty of criminal negligence, but, on account of the fact that he had spent four months in jail, was discharged on suspended sentence.

Two men were killed while shaft-sinking by reason of the drilling equipment not being properly attached to the cable while being raised or lowered. At the City of Cobalt main shaft on June 22nd a drill helper was struck by a machine bar which fell while being hoisted from the bottom; at the Levack mine on June 27th a drill runner was struck by a column arm which became loosened from the column while being lowered.

Four fatal accidents occurred while men were being hoisted in the cage or bucket. On February 24th at the Hewitt mine a drill runner fell out of the bucket, while being hoisted away from a round of holes which had been lighted, and was killed either by the fall or the explosions. A battery was not used in this work, as required by the Mining Act. On April 21st at the Dome Lake mine a timberman attempted to ring the signal bell while passing a level, and was caught against the timber and killed. At the same mine, on August 8th, a drill helper fell out of the bucket at a point about 15 feet below the landing level. At the Hollinger mine on April 21st a drill helper collapsed on an open cage, while gassed, and was crushed against the shaft timbers. The drill runner was fined for failure to observe due care for the avoidance of injury to a fellow workman in not accompanying his helper to the surface.

Two men were killed in winze accidents. At the Kerr Lake mine on June 12th a Galician trammer shoved his car into the winze and fell with it 50 feet to the bottom. At the Curry mine in South Lorrain a drill helper in some unaccountable manner fell into the winze after unloading the bucket.

Accidents from Explosives

Twenty men were injured and 13 men killed in 1914 in accidents due to the use of explosives. Of the fatal accidents ten occurred at mines and three at quarries. As in previous years, most of these accidents were due to carelessness and ignorance in the handling of explosives.

Five men were killed in accidents classified under the heading of "Premature explosion while loading or lighting holes." Two accidents, one at the Helen and one at the Magpie, occurred while firing sand-blasts. The Worthington accident occurred while firing a series of bench blasts in a stope. These three accidents were probably the result of the explosive not being properly covered. A blaster's helper was killed at the Porcupine Crown mine on November 6th. The blaster, an experienced man, considered the accident due to a "quick fuse," but there is a strong probability that, owing to difficulty in lighting some of the fuses, the men remained longer at the face than they realized. The Beaver accident was evidently caused by a fuse becoming ignited from the flame of a carbide lamp hung on the wall.

Only one fatality resulted from drilling into a missed or cut-off hole, and in this case the hole was so situated that detection was difficult. Two men were asphyxiated at the Garson mine while preparing to blast the squaring-up holes in a raise. These men had fired 50 sticks of 60 per cent. dynamite in the raise and had not blown any air. After waiting a couple of hours for the smoke to clear, they attempted to work in the raise, but collapsed while trying to escape. A quarry foreman was killed while attempting to break a rock containing explosive. At the Stitt claims, Kirkland lake, a miner was killed by picking into a missed hole in the shaft. Two fatal accidents occurred through men returning too soon to an unexploded shot, and a drill helper at a quarry was killed while attempting to clean out a missed hole with a drill steel.

"Don'ts" with Explosives

Miners' Circular No. 13, "Safety in Tunnelling," issued by the U. S. Bureau of Mines, gives the following "Don'ts" in the care and use of explosives:—

Don't rely in any degree whatsoever upon the supposed "inertness" of dynamite, but at all times use care in handling it.

Don't smoke while handling explosives, and don't handle explosives near an open light.

Don't shoot into explosives with a rifle or pistol, either in or out of a magazine.

Don't carry loose detonators (blasting caps) or electric detonators in the clothing. Carry them in special boxes.

Don't transport detonators or cartridges containing detonators (primers) to the heading in the same box or package with the supply of dynamite for the round, and do not place them side by side after they reach there.

Don't tap or otherwise investigate a detonator or electric detonator.

Don't attempt to take detonators from the box by inserting a wire, a nail, or any other sharp instrument.

Don't try to withdraw the wires from an electric detonator.

Storing

Don't leave explosives in a wet or damp place. Keep them in a suitable dry place, under lock and key, where children or irresponsible persons cannot get at them.

Don't store dynamite boxes on end, as nitroglycerine is more liable to leak from the cartridges.

Don't store or handle explosives near a residence.

Don't open packages of explosives in a magazine.

Don't open dynamite boxes with a nail puller or powder cans with a pickaxe.

Don't store or transport detonators and explosives together.

Don't store fuse in a hot place. This will change its normal rate of burning.

Don't keep detonators, electric detonators, or firing machines in a damp place.

Don't allow priming (the placing of a detonator or electric detonator in dynamite), to be done in a thawing house or magazine.

Thawing

Don't use frozen or chilled explosives. Most dynamite freezes at a temperature between 45° and 50° F.

Don't thaw dynamite on heated stoves, rocks, sand, bricks, or metal, or in an oven, and don't thaw dynamite in front of, near, or over a steam boiler or fire of any kind. Use thawers such as are furnished by the manufacturers of explosives.

Don't take dynamite into or near a blacksmith shop or a forge.

Don't put dynamite on shelves or other supports which are directly over steam or hot-water pipes or other heated metal surface.

Don't cut or break a dynamite cartridge while it is frozen, and don't rub a cartridge of dynamite in the hands to complete thawing.

Don't place a "hot-water thawer" over a fire, and never put dynamite directly into hot water or allow it to come into contact with steam.

Don't allow thawed dynamite to remain exposed to low temperature before using it. If it freezes before it is used, thaw it.

Preparing the Charge

Don't fasten a detonator to the fuse with the teeth or by flattening it with a knife; use a crimper. The ordinary detonator contains enough fulminate of mercury to blow a man's hand or head to pieces.

Don't "lace" fuse through dynamite cartridges. This practice is frequently responsible for the burning of the charge.

Don't explode a charge to chamber a hole and then immediately reload the hole; the hole will be hot and the second charge may explode prematurely.

Don't force a primer into a bore hole, and in tamping the charge use pressure rather than impact. Don't use a tamping bar as if it were a javelin.

Don't do tamping with iron or steel bars or tools. Use only a wooden tamping stick with no metal parts.

Don't handle fuse carelessly in cold weather, for when it is cold it is stiff and breaks easily.

Don't use fuse that has been stored or kept near a boiler, steam pipe, or any other source of heat, or that has been exposed to moisture.

Don't use fuse that has been hammered or injured by falling rocks or from any other source. Such injury increases the burning rate, and there have been cases where a fuse damaged in this manner burned almost instantaneously.

Don't cut fuse short to save time. It is dangerous economy.

Don't worry along with old broken leading wire or connecting wire for electric firing. A new supply will not cost much and will pay for itself many times over.

Firing the Charge

Don't explode a charge before everyone is well beyond the danger line and protected from flying debris. Protect the supply of explosives also from this source of accident.

Don't be in a hurry to find out why a charge failed to explode. In case of a missfire, allow at least 30 minutes to elapse before approaching the hole.

Don't drill, bore or pick out a charge that has failed to explode. Drill and charge another bore hole at least 2 feet from the missed hole.

Miscellaneous Accidents Underground

Not counting the winze accidents which were included with shaft accidents, there were four fatal accidents in 1914 under this heading, compared with eight during 1913.

At the Northern Pyrites mine a hammer-drill runner lost his balance and fell off a bench in the stope, falling with his machine a distance of about eight feet and fracturing his skull.

Two fatal accidents resulted from being buried by ore in stopes. At the Seneca-Superior attempts were being made to start the ore running when the accident occurred; while at the Garson mine the blasting of a chute which was hung up caused the accident. At the Townsite mine, while scaling in a raise, a drill runner was killed when the staging on which he was working was broken by falling rock.

Surface Accidents

Nine men were killed in surface accidents at the mines in 1914, compared with eight during the preceding year. Two men were killed during the construction of the addition to the Dome mill; two were drowned in Simpson lake; one was caught in mill machinery; one was killed by a broken derrick; one by an eight-foot fall; one in a runaway accident, and the master mechanic at the Tough-Oakes mine was fatally scalded when a tube blew out of a boiler which he was repairing.

Prosecutions

An employee of the Crown Reserve mine, Cobalt, was fined $10 and costs for a violation of Rule 13, Sec. 164, of the Mining Act.

An employee of the Hollinger mine, Timmins, was fined $10 and costs for a violation of Rule 98, Sec. 164, of the Mining Act.

An employee of the Creighton mine, charged with manslaughter in connection with an accident at that mine, was released on suspended sentence after being four months in jail.

Four smelter and two mine employees of the Canadian Copper Company, one employee of the Garson mine, and an employee of the Cobalt Lake mine were found guilty of violating Rule 97, Sec. 164 of the Mining Act, which reads as follows:

> No person under the influence of or carrying intoxicating liquor shall enter any mine or be in the proximity of any working place on the surface or near any machinery in motion.

In one case the costs of the court were assessed, and in the other cases fines ranging from $20 to $30 and costs were imposed.

Health of Miners

During 1914, some advance was made in dealing satisfactorily with the dust problem underground. The use of sprays has practically been discontinued. Water drills are coming into general use in drifts and cross-cuts, effectually preventing dust in these operations. During the latter part of 1914 water stopers appeared in the market and are now being tried out underground. If these drills prove satisfactory there will not be any difficulty from dust in drilling operations. Dust from shovelling can be avoided by wetting down the broken material, and the dust from blasting can be handled by having a blasting shift and cleaning out the mine before the regular shifts resume work.

The Miners' Phthisis Prevention Committee of the Union of South Africa in its interim report deals with the amount of dust produced by the several mining operations. As the dust in a miner's lung is exceedingly small in size, the majority of the particles being .001 millimetre or less in diameter, only the fine dust was considered in the committee's measurements; the quantities are given in milligrams per cubic metre

A series of measurements showed that in drifts and cross-cuts, while drilling dry, there were 59 milligrams of fine dust; drilling wet, 13 milligrams; shovelling dry, 18 milligrams; shovelling wet, 2 milligrams; after blasting, 286 milligrams.

This committee reached the following conclusions:

(1) That dust catchers are of little value in drilling, the only way to keep the air clear being to prevent the formation of dust by introducing water into the holes while being drilled.

(2) That water blasts, sprays and other devices are powerless to eliminate entirely the dust from the air after blasting.

(3) That respirators are not efficient as dust collectors.

(4) That the dust originated by blasting most closely resembles the dust in the silicotic lung.

(5) That when miners suffering from miner's consumption are employed, there is a risk of direct infection by tuberculosis underground, the ladderways being more especially infected.

Accident Prevention at Ontario Mines

During the past three years several mining companies in Ontario, in an effort to reduce the number of accidents occurring at their mines, have formed safety departments. In some cases this department is in charge of a safety engineer; in other cases a mine inspector is appointed who works in conjunction with the mine captain; while a third method is the appointment of safety committees. In all cases marked success has resulted. Following is a brief description of the methods adopted by the several companies.

The safety departments of the Dome Mines, Limited, and the Mond Nickel Company, having been formed only in the last two months of 1914, the details of their organizations have not yet been worked out.

Beaver

Mr. Frank Culver, President and General Manager of this company, states that the idea of a mine having its own inspector was suggested to him by Mr. Tom Jones, of the Buffalo mine, in a discussion regarding the prevention of accidents at mines. Mr. Jones intended to put on a mine inspector, and the idea so appealed to Mr. Culver, that he immediately appointed one, and worked out the details later.

The inspector at the Beaver, in the first place, is responsible only to the superintendent. The underground foremen have no authority over him whatsoever. He inspects the mine twice a day and fills out an inspection report for each shift. This report is signed by the outgoing and incoming shift boss, as well as the mine captain, and goes to the superintendent. Should this report show that certain conditions underground are unsatisfactory, the underground foremen are certainly going to remedy them, so that they will not have to sign a second unsatisfactory report and have it go to the superintendent. For repairs that are required, the inspector fills in a second report form in triplicate—one copy is handed to the person responsible for making the repairs; when repairs are completed, it is signed by this person and forwarded to the superintendent's office. All miners going on and off shift report at the inspector's office; the latter report any missed holes. Miners fire their own missed holes. When danger exists, such as a missed hole, bad ground, etc., a red flag is stuck up. Every man, no matter of what nationality, recognizes immediately that something is wrong. This does away with the danger of a verbal warning not being understood, and is one of the best features of the whole system of accident prevention. Regarding this feature the Engineering and Mining Journal of February 21st, 1914, says: "Intelligent initiative like this is only what might be expected from the Beaver, operating as it does under probably the most advanced and effective inspection system in the world."

The inspector's report, bringing to the attention of those responsible any repairs needed, also tends to greater efficiency. If a machine is out of order, chute blasted, pipe line broken, etc., repairs are immediately made, and men do not lose a couple of hours in getting to work.

The Temiskaming mine, being now under the same management as the Beaver mine, has the same system of inspection.

Buffalo

In December, 1911, The Buffalo Mines, Limited, established an inspection department in connection with all underground work in their mining operations at Cobalt. An inspector was appointed, with an office close to the chief exit from the mine, where the miners coming off and on shift could report. As each shift comes off the miners report holes blasted and any missed or cut-off holes.

In the interval between shifts the inspector makes a complete tour of the mine and inspects each working. Any missed or cut-off holes discovered are indicated by a red flag, left for that purpose, and the same are reported to the oncoming shift, with instructions to blast the flagged holes immediately and bring the flag back to the inspector's office. If missed or cut-off holes are covered by muck, a flag is left sticking in the muck pile to warn the muckers not to use a pick. When any loose ground or broken timber is discovered, or muck is hung up in stopes, a flag is left to mark the spot, and the scaling and timber gangs are instructed, when coming on shift, to make everything safe and return the flag to the inspector's office before proceeding with any further work. This system of warning by red flags eliminates any danger of verbal instructions or posted regulation being misunderstood, or unintelligible to foreigners; a miner of any nationality understands a red flag to mean danger.

All miners are instructed as to the law and the penalties for starting holes in old bottoms, leaving gates or guard-rails open, or pulling signal cords above or below where the cage is standing; notices are also posted to this effect.

In addition to an inspection of the work between each shift, the mine inspector makes a general tour of the whole mine once a week, making a complete inspection of all hoists, cables, signals, ladders, timber, manways, cars, cages, tracks, pumps, machines, air lines and powder magazines. The powder magazines are inspected twice daily and the temperature reported. No powder is allowed to be left in any place of work, and the powder man is instructed to bring back all powder not used, special attention being given to the inspection of the air courses and ventilation.

Every man going on duty passes under the inspector's observation, and no man is permitted by him to go underground in an unfit condition for work.

Economy is effected in the time saved, due to miners and shift bosses receiving a report of the conditions existing at their place of work before going underground; thus needed repairs are made immediately and dangerous conditions rectified before proceeding further.

Efficiency is increased, as all are aware that no lax conditions will be allowed to exist. The rigid inspection twice daily of all working places keeps the men up to a better standard of efficiency and attention to regulations than anything else could.

The dominant feature of the system is that carelessness will not be permitted, and when carelessness is overcome a large factor of danger is eliminated.

Cobalt Lake

At the Cobalt Lake mine in July, 1914, a safety committee was formed amongst the foremen and men. The manager, Mr. M. B. R. Gordon, in investigating several minor accidents, found that the majority of these accidents could easily have been avoided, and were due to the negligence of the employees. The ordinary precautions against accidents were being observed, but instances were continually occurring where the indifference or thoughtlessness of the employee was endangering his own safety or that of a fellow workman. A broken rung in a ladder not being repaired at once, carelessness in scaling small rock or cleaning off landings, etc., a workman sledging beside a trammer in a drift, broken board walks and nails left sticking through boards, tramming loaded cars too close to one another, and many other thoughtless practices, were the causes of numerous minor accidents. It was decided that the only way to overcome these conditions was to enlist the help of the men themselves. Consequently the safety committee was formed, with the manager as chairman. The several shift bosses were to be the heads of committees on different work; the shift bosses and fore-

men were to have with them two employees elected by the men themselves from their particular crews; the mill superintendent was to be vice-chairman, and in the shifts in the mill and machine shop a similar method was followed as in the mine. The two delegates to the committee from each shift, elected by the men, were, in the intervals between meetings, to gather such information themselves and from other employees as they deemed of interest to the main committee. Where any dangerous point was located it was to be at once reported to the head of their committee, and, according to the seriousness of the situation, either passed on up to the foreman, or sent direct to the chairman. But all these improvements, or places of danger, or accidents that had occurred, were to be reported at the next meeting for discussion by the other members.

By this method a considerable number of the most intelligent men on the property in all branches of the work were discussing every fortnight among themselves and with the manager the practices and conditions which appeared to them unsafe. This discussion invariably led to suggestions for improvements in methods, and the safety committee became also an efficiency committee.

Regarding the results, Mr. Gordon states: "The results obtained more than justified the trouble taken, for not only did the minor accidents practically cease, but we also obtained in a large degree much greater efficiency from our employees, and I can state definitely that it is a saving of time and money both to the employer and the employee."

Canadian Copper Company

The results obtained by the safety department of the Canadian Copper Company are shown in a comparison of the accident rate for 1913 and 1914, furnished by Mr. E. T. Corkill, safety engineer of the company.

The safety department of the Canadian Copper Company was organized in July, 1913, thus being in existence for six months of the year with which the comparisons of the accident rate for 1914 are made.

The fatal accident rate for 1914 was the lowest in the history of the company. By serious accident is meant all accidents which incapacitated a workman for more than 35 days. This includes all fractures, and in the mines department for 1914 included a number of accidents where the workman had his finger or toe badly bruised while tramming. These injuries are often very slow in healing, and, on account of the nature of the work, the injured man is not allowed to return to work until his injuries are fully healed. There were no accidents during the year causing permanent incapacity. A comparison of the accident rate for 1914 with that for 1913 shows the following:

Number fatalities per 1,000 men employed	.53;	or decrease of	90	per cent.	over	1913.
Number serious accidents	" 19;	"	19	"	"	"
Number minor accidents	" 70;	"	2	"	"	"

All the departments of the company showed a decrease in all classes of accidents, with the exception of the mines department in serious accidents, the increase in this case being due, as already pointed out, to the number of seriously bruised fingers and toes among the trammers. The last half of the year has shown a marked decrease in this class of accidents, due to change in the underground conditions and to fewer men being employed in the older levels of the mines, where the clearance for the tram cars under the old drywalls and at chutes was not sufficient. The installation of the crusher on the sixth level, and the putting in of an ore pass from the fifth to the sixth levels at Creighton mine, have eliminated the dumping of cars directly into skips, and consequently the congestion of tram cars around the stations, due to the waiting for skips.

All the ore from the fifth and sixth levels at No. 2 shaft is now put through the crusher and into a storage bin from which the skips are loaded. This improvement has lowered the accident rate among the trammers very materially.

Following is a comparison of the accidents in the various departments during 1914 with the year 1913:

Mines Department—

Fatal accidents	84 per cent. decrease.
Serious "	18 per cent. increase.
Minor "	Same as 1913.

Smelter Department—

Fatal accidents	None; 3 in 1913.
Serious "	33 per cent. decrease.
Minor "	" "

Mechanical Department—

Fatal accidents	None; same in 1913.
Serious "	70 per cent. decrease.
Minor "	17 per cent. decrease.

Transportation Department—

Fatal accidents	None; 2 in 1913.
Serious "	65 per cent. decrease.
Minor "	48 per cent. decrease.

Electrical Department—

Fatal accidents	None; 1 in 1913.
Serious "	None, compared with 33 per 1,000 men employed in 1913.
Minor "	55 per cent. decrease.

A great deal of credit is due the superintendents and foremen of the various departments for the work they have done in keeping down the accident rate, and the interest they have taken in accident prevention. Little can be accomplished in the work without the whole-hearted support of the foremen. These men are on the work all the time, and are able to see the dangerous practices and conditions and correct them before any accident happens.

Particular mention should be made of the good work done at the Creighton mine. There were no fatalities at this mine during 1914, which is the first year since 1906, without at least one. The mine superintendent, Chas. Miller, deserves great credit for this record. With the coming into force on January 1st, 1915, of the Workmen's Compensation Act, it was decided to discontinue the Canadian Copper Company Accident Association. This association was organized in 1894 and has been in operation from that time until December 31st, 1914, a little over 20 years.

The management consisted of a president, vice-president, secretary-treasurer, and a committee composed of employees from each department. The officers and committee were elected annually at a general meeting of the employees. Each and every employee was assessed 50 cents per month, and the total receipts of the Association amounted to $171,411.75. When an employee was injured, either at work or at home, he was paid $1.00 per day during the period of disablement; provided he was incapacitated more than four days. The dependents of an employee who lost his life were paid $400 and funeral expenses. During the life of the Association the sum of $167,943.38 was paid out to injured employees and to dependents of employees who lost their lives from accident.

The Association was very popular with the workmen, and proved of great assistance to those employees who were incapacitated and to the dependents of men who were killed.

Dome Mines

During the later part of 1914 a trained mechanical engineer was appointed safety engineer at the Dome mine and a committee on safety, sanitation and efficiency was formed. The committee consists of the heads of the operating departments, and meets once a month. The safety engineer makes a daily inspection of the various parts of the mine and plants, and sees that all safety recommendations made to department superintendents are complied with.

General Chemical Company

The General Chemical Company, of which the Nichols Chemical Company, Sulphide, Ontario, is a subsidiary concern, employ 3,000 men in their various mines and chemical plants throughout the United States and Canada. In Ontario the chemical works and mine at Sulphide, in Hastings county, are operated by this company. The manufacture of chemicals in a modern plant under expert supervision is not essentially a dangerous occupation, nevertheless a large number of serious non-fatal accidents indicated to the company the need of a "safety-first" campaign among all its employees. Accordingly, what is known as a "central service committee" was established at the New York office in charge of Mr. Robert K. Painter, mining engineer. Acting with Mr. Painter are Mr. Black, sanitary engineer; Dr. Talbot, consulting engineer; Mr. J. R. Bueno, secretary and general manager; Mr. W. H. Nichols, Jr., member ex-officio.

The function of this service committee is the supervision and study of all matters pertaining to safety and sanitation throughout all the company's works, including also welfare work among the employees.

Bulletins are issued monthly by the committee, containing extracts from papers read before conventions and societies regarding safety methods and devices. Latterly, also, this bulletin has included a comparative statement showing all accidents at the various plants; copies are distributed among the employees and those interested.

At the Sulphide plant, under superintendent W. H. DeBlois, there has been established what is known as the "works safety committee," consisting of one employee from each department of the plant, the mine itself having a separate and similar organization. The departments represented are as follows:—

1. Rock house at mine.
2. Mechanical department.
3. Burner and crusher department.
4. Sulphuric acid department.
5. Nitric and hydrochloric acid department.

Each member inspects the whole works in turn and reports to the superintendent on a form provided for that purpose. The various suggestions are considered by the superintendent and the foreman of the department interested, and those approved are ordered to be carried out at once. The form has space at the bottom for the signature of foremen certifying to work being completed as directed. The committee also investigates and reports on any important accident.

A first-aid equipment, including pulmotor and surgical instruments, is on hand for immediate use, and is in charge of chief chemist Jordan. The company's physician visits the plant regularly, and under ordinary conditions can reach the plant in twenty minutes if required.

At various points about the works are posted photographs published and distributed by the National Council for Industrial Safety, Chicago. One card, for example, shows a workman's hand swollen and permanently deformed as a result of blood poisoning from a neglected scratch on the finger. Beneath this photograph is printed the following warning: "This emphasizes the necessity for impressing on workmen that they must tell their foremen whenever they are hurt, even if it be only a scratch, so that proper means may be taken to prevent complications."

Mond Nickel Company

In the latter part of 1914 a safety engineer was appointed by the Mond Nickel Company with headquarters at the Garson mine, that being the property which had the highest accident rate. Two rule books have been published by the company, one for the superintendents and foremen, the other for employees at mines.

Nipissing Mining Company

The Nipissing Mining Company have prepared an excellent rule book which is published in English, French and Finnish. A copy of this rule book is given to every person who becomes an employee of the company and a receipt taken, thus impressing on the employee the necessity for reading and observing the rules of the company.

The Steel Company of Canada, Limited

Realizing the necessity of a "safety-first" organization among its employees, the above company issued on January 1st, 1913, a book of rules covering all departments, a copy of which is given to every employee. These rules were formulated by a committee of departmental heads, and the penalties for infraction are very drastic. Every foreman is responsible for the instruction of the men in his charge in these regulations, and a proper understanding of the same by them. What might be termed an interlocking system of reports from one department to the other is enforced, whereby a workman from one department ordered to work in another must first report to the head of that department before starting work. For example, a machinist from the mechanical department is ordered to make certain repairs on the crane track. He must first report to the chief electrician, who will send an electrician with him to see that he does not come in contact with high-tension wires, etc.

The introduction to the book of rules includes a letter from General Manager R. Hobson, from which the following extracts are taken:—

The prevention of accidents to its employees is the earnest desire of The Steel Company of Canada, Limited. While the company may provide all possible safety appliances, accidents will be of more or less frequent occurrence if employees do not assist in their prevention by cultivating habits of caution. For the guidance of employees this set of rules, regulations and suggestions is issued, and it is the earnest wish of the company that they be carefully studied and lived up to. Not only is it the duty of every employee to individually exercise care and caution, but it is his duty to see that his fellow-workman does not violate any rule. All the safety appliances in the world will not prevent accidents if every man is not on the watch to guard against them.

The following memorandum was recently issued to the heads of departments:—

1. Safety committees must be at once formed in each department.
2. Each committee will consist of three employees, who will act for three months.
3. The committees will make regular inspections during the company's time, of plant, machinery, tracks, etc., belonging to their respective departments.
4. Report to the central committee any changes which they consider will add to the safety of employees.
5. These changes will be considered by the central committee, who will decide as to whether they shall be adopted or not.
6. The central committee to consist of the manager of works, the superintendent or head foreman, together with one other person selected by the manager.
7. The safety committee should make the inspection of their departments at least once a month and report on general conditions of departments, recommend changes where safety could be promoted, and make suggestions on accidents which have happened during the past month.
8. Cleanliness and order should always be considered as an essential of safety, and department committees should carefully take note of places where improvements could be made along these lines.
9. I am sending you herewith blue print of safety signs, which may be had from our purchasing department, and which you will please hand to your safety committee, who will see that they are placed at all danger points. Plain enamelled signs can also be supplied.

10. Goggles for the protection of eyes will be supplied, and when men refuse or neglect to use them when engaged on work where there is danger of eyes being injured, they should be at once discharged.

12. Any employee who is careless with regard to his own safety or the safety of his fellow-workmen, or who is known to be of intemperate habits, must be dismissed.

Dr. Talbot, of the General Chemical Company, says that a distinction must be made between "first-aid" treatment and "emergency treatment." There are instances on record where first aid has been given that had not been aid, but an injury, and the company has had to pay for it. In other words, first aid should never take the place of skilled aid. Yet real first aid oftentimes will make the necessity of skilled aid less expensive and less necessary. First aid is merely what can be done to avoid the necessity for skilled aid. In emergency treatment, however, we have something entirely different. In every works we should not only have first aid men and understudies for first aid men, but there should be somebody, night as well as day, always available to give emergency treatment also.

The Steel Company of Canada made this distinction between first aid and emergency aid nearly two years ago, and built an emergency hospital at the works, in charge of Sergeant Matthews, an English Army officer, retired after long service in India and Africa. He is on duty night and day at the hospital, and his records show that for the six months ending April 30th, 1914, 432 cases were given emergency treatment. The majority of these cases were bruised hands and feet, cuts and burns, minor injuries to eyes, gassing cases from the furnaces, etc. Sergeant Matthews organized first aid classes in the works, and now has fifty-two thoroughly instructed young men scattered throughout the various plants, twenty-eight of whom are at the steel plant. Most of these have passed second- and third-year lectures and have been given certificates. Three of them have taken the full course at the Halifax Military Hospital, their course being paid for by the Militia Department.

Table of Fatal Accidents in

No.	Date 1914	Name of Mine.	Name of Owner.	Name of Deceased.	Occupation of Deceased.
1	May 2	Helen...........	Algoma Steel Corporn..	Giacinto Zanetti.	Drill runner..
2	July 2	do	do do ..	Dante Boni......	Trammer.....
3	Aug. 21	do	do do ..	Pietro Poi.......	Blaster........
4	" 7	Magpie..........	do do ..	Stefin Baldovin..	Drill runner..
5	June 25	Beaver...........	Beaver Con. Mines, Ltd.	Andrew Krawiec.	Drill runner..
6	" 25	No. 2..........	Canadian Copper Co...	F. J. Bedford....	Shift boss.....
7	" 22	City of Cobalt....	City of Cobalt Mining Co.	Jan. Syrytiuk....	Drill helper...
8	Jan. 20	Cobalt Lake.....	Cobalt Lake Mining Co.	W. Janes	Foreman......
9	Mar. 17	Townsite........	Cobalt Townsite Mining Co.	G. Holovaci......	Drill runner..
10	June 4	Coniagas.........	Coniagas Mines, Ltd. .	J. Symons.......	Teamster.....
11	Mar. 7	Crown Reserve...	Crown Reserve Mining Co.	J. Johnson.......	Timberman...
12	Jan. 26	Dome............	Dome Mines, Ltd.	Napoleon Roy....	Riveter.......
13	Ap'l 16	do	do do	R. Gutcher......	Carpenter.....
14	Nov. 14	do	do do	H. Adams.......	Millman......
15	Ap'l 21	Dome Lake......	Dome Lake Mining and Milling Co.	G. Powell........	Timberman...
16	Aug. 8	do	do	W. E. Moody....	Drill helper...
17	Feb. 24	Hewitt...........	Hewitt Lake Mining Co.	J. Dunn..........	Drill runner..
18	Ap'l 28	Hollinger........	Hollinger Gold Mines, Ltd..................	S. Samulski.....	Drill helper...
19	June 12	Kerr Lake.......	Kerr Lake Mining Co..	K. Haidasz......	Trammer.....
20	Oct. 31	Lacey............	Loughborough Mining Co.	J. Abrams.......	Drill runner...
21	Mar. 28	Garson..........	Mond Nickel Co.	E. Matson........	Drill runner..
	" 28	do	do	H. Kalari........	Drill helper...
22	May 6	Worthington.....	do	G. Mudri.........	Drill runner..
23	June 20	Garson...........	do	A. Nasi..........	Drill runner..
24	" 27	Levack..........	do	W. Nastonen.....	Drill runner..
25	July 27	North Star.......	do	H. Kohtala.......	Labourer......
26	Aug. 12	Garson..........	do	F. Breen.........	Drill runner...
27	Nov. 26	do	do	B. Barberio......	Drill helper...
28	May 1	Northern Pyrites.	Northern Pyrites Co...	G. Della Skiova..	Drill runner..
29	Nov. 21	Curry...........	Pittsburg Lorraine Syndicate	C. Beland........	Drill helper...
30	" 6	Porcupine Crown.	Porcupine Crown Mines, Ltd.	J. Mosher.......	Blaster........
31	Jan. 18	Miracle..........	Porcupine Miracle Mining Co.	M. Mushta.......	Trammer......
32	Oct. 26	Little Pet........	Porcupine Pet Gold Mines	Mark Hanna.....	Foreman......
	" 26	do	do	Chas. Carino.....	Labourer......
33	Ap'l 3	Seneca-Superior..	Seneca-Superior Silver Mines, Ltd.	R. Hull.........	Deckman......
34	" 30	do ...	do	A. Wigsted......	Drill runner..
35	Dec. 15	Stitt Claims......		R. Martin.......	Drill runner..
36	July 11	Tough-Oakes.....	Tough-Oakes Gold Mines	M. G. Lloyd.....	Mechanic.....

or about the Mines, 1914.

Nationality of Deceased.	Age	Married or single	Below ground	Above ground	Cause of Accident.
Italian..............	28	S	1	......	Caught in drift by run of ore and suffocated.
Italian..............	22	S	1	......	Caught in drift by run of ore and head crushed.
Italian..............	31	S	1	......	Premature explosion while sand blasting.
Italian..............	35	M	1	......	Premature explosion while sand blasting.
Austrian............	23	S	1	......	Premature explosion in raise while blasting.
English-speaking....	28	M	1	......	Bedford was under skip examining bent axle when skip was rung down from lower level; crushed between wheel and timber.
Galician............	30	M	1	......	Bar fell in shaft, crushing foot; died from lockjaw on June 29th.
English-speaking....	40	M	.....	1	Struck by falling boom of derrick.
Roumanian.........	26	S	1	......	Fell while scaling in raise.
English-speaking....	32	M	.....	1	Injured in runaway; died June 8th.
Finn...............	45	M	1	......	Crushed by fall of rock.
English-speaking....	36	S	.....	1	Fell from scaffold while working on mill construction.
English-speaking....	61	M	.....	1	Fell into elevator pit.
English-speaking....	22	S	.....	1	Caught in driving belt of stamp battery while oiling.
English-speaking....	37	S	1	......	Fell from cage.
English-speaking....	26	S	1	......	Fell out of bucket.
English-speaking....	38	S	1	......	Fell out of bucket.
German.............	28	S	1	......	Fell on bottom of cage and head crushed.
Galician............	33	M	1	......	Fell down winze with car.
English-speaking....	27	M	1	......	Staging in shaft collapsed while removing timbers.
Finn...............	26	M	1	....	Overcome by gas in raise while preparing to refire round.
Finn...............	26	M	1	....	
Austrian............	23	S	1	......	Premature explosion while lighting fuse.
Finn...............	32	M	1	......	Delayed explosion while sand blasting.
Finn...............	35	S	1	......	While hoisting tools out of shaft, arm fell striking him on head.
Finn...............	34	S	.....	1	While dismantling dry-house fell about 8 feet.
English-speaking....	26	S	1	......	Caught by run of ore while working in stope over mill-hole.
Italian.............	23	S	1	......	Drilled into missed or cut-off hole.
Italian.............	30	M	1	......	Fell off bench with drill while starting hole.
English-speaking....	23	M	1	......	Fell down winze after unloading tools from bucket.
English-speaking....	19	S	1	......	Premature explosion while firing in stope.
Russian............	32	M	1	......	Stepped on bucket and bucket dropped to bottom of shaft; brake not set.
English-speaking...	35	M	.....	1	Drowned in Simpson lake while repairing suction from small boat.
Italian.............	22	S	.....	1	
English-speaking....	26	M	1	......	Fell down shaft with car.
Finn...............	24	S	1	......	Buried by run of ore in stope.
English-speaking....	25	S	1	......	Picked into missed hole in shaft.
English-speaking....	45	M	.....	1	Tube blew out of boiler.
	Totals....		29	9	

Accidents at Metallurgical Works

The metallurgical works which come under the Mining Act of Ontario include blast furnaces, copper-nickel smelters and converter plants, silver smelters and acid plants.

At these works during 1914 there were 104 accidents which were reported to this Department. Four of the accidents were fatal, causing the death of five men. The 100 non-fatal accidents caused injuries to 101 employees.

This is a marked decrease compared with the preceding year, when 11 men were killed and 201 injured, partly, no doubt, due to the fact that during the last five months of the year several metallurgical plants were either idle or working on a reduced scale. The four fatal accidents occurred during the first four months of the year.

On January 13th owing to extremely cold weather the ore charge became frozen in the hopper in the upper bell of the blast furnace at the works of the Canadian Furnace Company, Port Colborne. An Italian, E. Tissiott, while trying to loosen the ore with a bar, fell into the lower bell. The foreman, R. L. Brooks, immediately jumped in after him, but both men were asphyxiated before they could be pulled out.

On January 15th a brakeman, H. Benoit, was injured in a wreck in the smelter yards of the Mond Nickel Company, and died from his injuries three days later.

On February 1st the keeper of No. 3 blast furnace of the Algoma Steel Corporation, Peter Rofel, was burned by flame and molten cinder ash escaping from No. 4 blowpipe, and died from his injuries on February 4th.

On April 16th a labourer around the Coniston smelter of the Mond Nickel Company, named M. Ulycznij, was suffocated in a fines bin.

Cause and Place of Fatalities

	1913	1914
Blast Furnaces:—		
Asphyxiation from furnace gas	1	2
Electrocution	1	0
Crushed between crane platforms	1	0
Struck by bar of mud gun	1	0
Struck by broken machinery	1	0
Burned by furnace material	0	1
	5	3
Copper-Nickel Smelters and Converter Plants:		
Struck by train	3	0
Fell and struck head	1	0
Burned by spilled matte	1	0
Crushed in train wreck	0	1
Suffocated in fines bin	0	1
	5	2
Acid Plant:		
Caught in machinery	1	0
Total	11	5

Cause of Non-Fatal Accidents at Metallurgical Works

The following schedule shows the causes of the non-fatal accidents in 1913, at the metallurgical works, and the number injured:—

Burned	30
Falling objects	16
Falling from elevated places	9
Slipped and fell	13
Caught by machinery	12
Injured by cars	5
Crushed between two objects	6
Cut by slag, matte, etc.	3
Struck by hammer	3
Foreign substance in eye	3
Miscellaneous	1
Total	101

In the subjoined table is given the occupation and nationality of the men injured in metallurgical works.

Occupation.	English speaking.	Italian.	Pole.	Austrian	Russian.	Finn.	Total
Stove tender	2	......	1	......	......	......	3
Engineer	2	......	......	......	......	......	2
Furnace helper	......	3	3	......	......	......	6
Furnace keeper	......	1	2	1	......	......	4
Labourer	9	21	10	1	1	......	42
Pourer	......	4	......	......	......	......	4
Foreman	2	1	......	......	......	......	3
Cinder snapper	......	1	2	......	......	......	3
Blacksmith	2	......	......	......	......	......	2
Mechanic	5	......	......	......	......	......	5
Fireman	1	......	......	......	......	......	1
Railway conductor	3	......	......	......	......	......	3
Baleman	1	3	2	......	......	......	6
Brakeman	1	2	1	......	......	......	4
Tapper	......	2	......	......	......	......	2
Carpenter	5	1	......	......	......	1	7
Cyanide man	1	......	......	......	......	......	1
Electrician	1	......	......	......	......	......	1
Teamster	1	......	......	......	......	......	1
Nitric runner	1	......	......	......	......	......	1
Totals	37	39	21	2	1	1	101

The ages of the men injured were as follows:

17 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51–60	Unknown.	Total.
9	20	27	22	5	7	1	5	5	101

Table of Fatal Accidents at

Number.	Date 1914.	Name of Works.	Name of Owner.	Name of Deceased.	Occupation of Deceased.
1	Feb. 1...	Blast Furnace ..	Algoma Steel Corporn.	Peter Rofel....	Keeper.........
2	Jan. 13...	" " ..	Canadian Furnace Co.	R. L. Brooks...	Blower.........
	" 13...	" " ..	do do	E. Tissiott.....	Scale car oper...
3	" 15...	Smelter Yard ..	Mond Nickel Co.....	H. Benoit......	Brakeman.....
4	Ap'l 16...	Sintering Plant .	do do	M. Ulycznij....	Labourer.......

Table of Fatal Accidents

Number.	Date, 1914.	Name of Works.	Name of Owner.	Name of Deceased.	Occupation of Deceased.
1	Aug. 5	Gravel pit.........	Armstrong Supply Co..	Harry Barker.	Labourer......
2	Ap'l 25	Yard..............	Canada Crushed Stone Corporation	A. Starling....	Loader.........
3	May 21	Crusher trestle....	do do	G. Niblock....	Foreman......
4	July 24	Gravel pit.........	Clifton Sand & Gravel Corporation	J. Irwin.......	Hoistman.....
5	Mar. 13	Clay pit...........	Dominion Sewer Pipe Co.	F. Sicilia.....	Labourer......
6	" 14	Gravel pit.........	Wesley Ellins	D. McCluskey.	Teamster......
7	May 20	Quarry............	St. Mary's Horse Shoe Quarry	J. Ciccale.....	Labourer......
8	Mar. 4	Quarry............	Intercities Quarries Ltd.	V. Pevi.......	Labourer......
9	" 3	Gravel pit.........	Kingston Sand & Gravel Co.	J. Bowers.....	Engineer......
10	Dec. 9	Gravel pit.........	Ontario Sand Co.	G. Harriott...	Teamster......
11	Jan. 13	Clay pit.........	Jas. Pears & Son	W. Martin....	Labourer......
	" 13	do	do do	G. Woodhouse.	Labourer......
12	Feb. 25	do	Russell Brick Works..	E. Smith......	Foreman......
13	Sept. 25	Quarry............	Standard White Lime Co.	R. Constable...	Hoistman.....
14	" 19	Woodmill Point Quarry..........	The Coast & Lakes Contracting Co.	G. Di Rubis...	Drill helper...

Metallurgical Works, 1914.

Nationality of Deceased.	Age.	Married or Single.	Nature and Cause of Accident.
Austrian	45	M	Burned by furnace material escaping through blow pipe.
English-speaking	47	M	Asphyxiated while attempting to save fellow employee.
Italian	21	S	Fell into hopper and was asphyxiated.
English-speaking	20	S	Crushed when car on which he was riding on main line fouled car on siding.
Austrian	18	S	Suffocated in fines bin.

at Quarries, 1914.

Nationality of Deceased.	Age.	Married or Single.	In Quarry.	Outside Quarry.	Nature and Cause of Accident.
English-speaking	45	M	1	......	Suffocated by fall of sand.
English-speaking	34	M	.....	1	Fell beneath railroad car and crushed.
English-speaking	55	M	.....	1	Explosion occurred while attempting to break rock containing powder.
English-speaking	25	M	1	......	Suffocated by fall of sand while spudding face of bank.
Italian	35	M	.....	1	Crushed when electric shovel overturned.
English-speaking	22	S	1	......	Crushed by fall of sand while loading waggon.
Italian	21	S	1	......	Killed by fall of stone from face of quarry.
Finn	32	S	1	......	Rock rolled down and struck him.
English-speaking	36	M	1	......	Crushed while attempting to move large block of frozen sand.
English-speaking	21	S	1	......	Explosion occurred when deceased returned to refire hole.
English-speaking	37	M	1	....	Undermining clay bank when bank fell.
English-speaking	50	M	1	....	Undermining clay bank when bank fell.
English-speaking	35	M	1	......	Fall of clay from bank hit him.
English-speaking	34	M	1	......	Fell from oiling platform when platform collapsed.
Italian	19	S	1	......	Explosion occurred while cleaning out missed hole with drill steel.

Accidents at Quarries

Under this heading are classified the accidents that occur in all kinds of stone quarries, gravel pits and excavations at brickyards and cement works. During 1914 there were 30 serious accidents at such works reported to this Department. Fourteen of the accidents were fatal, resulting in 15 men being killed. It is evident that only a small proportion of the non-fatal accidents are being reported.

The accident rate at such works is undoubtedly high, especially at the gravel pits and clay banks. Until recently there was no inspection of these works, and the operations are usually in charge of foremen and performed by workmen who have very little knowledge of the danger of undermining or of the handling of explosives. A bank is undermined until it falls by its own weight, and powder is handled as if an explosion were impossible unless desired by the operator. It is not uncommon during the cold weather to find four or five workmen having a comfortable after-dinner smoke beside a red hot stove in a little shack, at the same time thawing powder by means of direct heat. When remonstrated with regarding dangerous practices the usual reply is "I have worked this pit for 20 years, and never had an accident." A pit employing five men and having one fatal accident in 40 years would have an accident rate of 5 to 1,000; which is much higher than the mines' rate for the whole Province.

Six men were killed by material falling from the face of the undermined bank, and three by material rolling down the face. The majority of these accidents could have been avoided by keeping the bank properly sloped. There was no excuse for the three accidents from explosives. One was caused by trying to remove powder from a rock by breaking the rock with a hammer; one by cleaning out a missed hole with a drill steel; the third by returning too soon to a shot which had not exploded.

The occupation of the men killed and the nationalities are shown in the following table:—

Occupation.	English Speaking.	Italian.	Finn.	Total.
Labourer	4	2	1	7
Foreman	2	....	....	2
Hoistman	3	....	....	3
Teamster	2	....	....	2
Drill helper	....	1	....	1
Totals	11	3	1	15

The ages of the men killed at the quarries were as follows:—

17–20	21–25	30–35	36–40	41–46	50–55	Total.
1	4	5	2	1	2	15

The following shows the causes of the fatalities at the quarries compared with the preceding year:—

	1913.	1914.
Struck by material from bank	3	9
Premature explosion	2	3
Picked up in clam shell	1	0
Crushed by machinery	2	2
Fall from derrick	0	1
Totals	8	15

MINES OF ONTARIO

Chief Inspector of Mines, T. F. Sutherland, Toronto; Inspectors, E. A. Collins, Kingston; J. G. McMillan, Cobalt; James Bartlett, Sudbury

I.—NORTHWESTERN ONTARIO

West of Lake Superior, notwithstanding the many known mineral areas, the mining industry is in a stagnant condition. Very few prospectors worked here in 1914, and the general lack of interest in prospecting and mining in this territory is remarkable. In view of the success of gold mining at Porcupine and the developments in recent years in the metallurgy of gold ores, one would expect a revival of interest in some of the old gold fields in Western Ontario.

The pyrite mine of the Northern Pyrites Company near Sioux Lookout is the only important producer in the whole of this enormous territory. At the West Beaver silver mine in O'Connor township the Trethewey Silver Cobalt Mining Company did some underground prospecting, but dropped their option. A little development work was also done at the Elizabeth gold mine near Atikokan, and at the old Scramble gold mine near Kenora, now owned by the Canadian Homestake Gold Mining Company.

Northern Pyrites Company

The Northern Pyrites Company, a subsidiary of the General Chemical Company of New York, operated the pyrite mine at Northpines, Ont., steadily in 1914, and in April 1915 began work on a number of improvements with a view to increasing the output.

New equipment has been purchased so that lump ore and concentrates may be shipped. The latter will be derived from lean silicious ore encountered in portions of the main ore body and along the hanging wall. The proposed arrangement of the plant is as follows:—

The hoist is a Lambert engine, 15-inch by 16-inch, capable of hoisting a two-ton load from a depth of 1,000 feet. Under the head frame is a 400-ton timber and steel ore bin. This will provide sufficient capacity to store the ore hoisted on night shift and the mill will be operated only during the day. An automatic feed delivers the ore from the bin to an 18-inch by 30-inch water-cooled Traylor jaw crusher which reduces to 5-inch. The ore is then taken by a bucket elevator to grizzlies which deliver the lump ore to a picking belt. The rock, picked from this belt, goes through chutes to the dump, while second-class ore is placed in a special chute. A No. 3 Austin gyratory crusher then reduces the 5-inch ore to 2½-inch. Short Colorado Iron Works Company impact screens remove the fines produced in the second crushing. The lump ore passes to the shipping bins; the fines from the grizzlies and from the impact screen pass to a No. 2 Bacon automatic plunger jig.

The second-class ore picked from the belt is reduced to ¾-inch in a 7-inch by 9-inch Dodge jaw crusher. This material is then treated in the jig mentioned above, which delivers three products:—

(1) Reasonably clean tailings.

(2) Middlings from spout for recrushing in a set of 10-inch by 21-inch Sturtevant rolls.

(3) A small proportion of fine concentrates from the hutch.

The discharge from the rolls goes to an impact sand screen. The oversize returns to the rolls and the undersize passes to two Deister sand tables, right- and left-handed, to treat 10- to 20-mesh material. The concentrates from these tables pass to the fines bins and the tailings to the dump.

The ore is delivered to the Grand Trunk Pacific railway at a point north of the mine and seven miles west of Graham (or Sioux Lookout) by a Leschen aerial tramway, two miles long. The buckets are of 1,000-pound capacity. At the discharge end of the tramway the ore can be fed directly to the railway cars through a bin, or stock-

piled. The stock-piled ore is loaded on railway cars by a 10-ton Industrial crane. The ore is shipped during the season of navigation to American lake ports, via Fort William.

The deposit of pyrite at this mine is the largest so far worked in Ontario. The vein, or band, varies from 30 to 68 feet in width, with an average of probably 45 feet and is at least 1,000 feet long. It strikes northeast and southwest and dips to the north-west at 55 degrees. The ore is fine-grained and extremely hard.

The head office of the company is at 25 Broad St., New York. Mr. Hedley V. Smythe is superintendent. About 130 men are employed.

West Beaver Silver Mine

The Trethewey Silver Cobalt Mining Company kindly supplied the following data concerning the West Beaver silver mine:—

Regarding the West Beaver silver mine, 140T, O'Connor township, Port Arthur Mining Division, would state that work done, while under option to the Trethewey Silver Cobalt Mine, Limited, consisted of the erection of buildings, cutting out and timbering a shaft station on the adit level 78 feet below the collar of the shaft, sinking the shaft to a depth of 60 feet below the adit level, and cutting out and timbering a station at the 50-foot level, from which drifting was carried on along the vein north-east 5 feet and southwest 100 feet. The shaft is a two-compartment, inclined shaft, 10 feet by 6 feet in the clear, and divided into a 6-foot by 6-foot hoisting compartment, equipped with a horse whim, cable and self-dumping bucket, and a 6-foot by 4-foot ladderway. A raise was put up in the southwest drift about 35 feet from the shaft to a height of 15 feet, to test the ore-shoot under the old stope above the adit level.

The shaft, drifts and raise follow the vein, which varies from 18 inches to 42 inches in width, with an average width of 36 inches, and dips to the northwest at 74 degrees, cutting Huronian slates which dip to the west at about 4 degrees. The vein filling consists of calcite, quartz, fluorite, sphalerite, galena, pyrite, argentite and native silver, in amount according to the order named. The calcite, quartz, fluorite and sphalerite are well banded and occur consistently, the remaining minerals being confined to pockets.

Preliminary surface prospecting located two parallel veins lying southeast and northwest of the principal vein. No work was done on these discoveries other than inspecting old test-pits.

The Trethewey Silver Cobalt Mine dropped their option on May 26th, 1914.

Elizabeth Gold Mine

The property of the Elizabeth Gold Mines, Limited, is situated about ten miles west of Atikokan station. The mine can be reached by canoe from Atikokan by taking the Atikokan river to Steeprock lake, thence down the Seine river, up Rice creek and across Rice lake. The mine lies a quarter of a mile north of Rice lake.

The outcrop consists of a quartz vein four feet wide, striking north and south. Greenstone forms the east wall and a squeezed granite the west.

A two-compartment shaft extends to a depth of 275 feet. Levels have been driven at 65 feet, 146 feet and 246 feet.

On the first level a drift runs north for about 125 feet, and the ground is stoped to within 20 feet of the surface.

On the second level a drift runs north about 180 feet, and a stope extends some distance above the level. From a point near the shaft a cross-cut has been driven west 100 feet.

On the third level drifting has been done south 150 feet and north about the same distance. At 30 feet north of the shaft a cross-cut has been driven west 60 feet and at 40 feet north a second cross-cut goes east 30 feet.

The mill was operated only during part of the month of May. It contains:—10 stamps with two Jenckes mortars, a 65-h.p. Williams return tube boiler, a No. 2 McCully gyratory crusher and two Jenckes engines.

The mine was closed down on August 1st, 1914.

Mr. R. R. Gamey is president of the company. At the time of last inspection (July 24th, 1914) Mr. Henry Shields was superintendent, and had 24 men on the pay-roll.

The Canadian Homestake Gold Mining Company

The property of the Canadian Homestake Gold Mining Company, Limited, formerly known as the Scramble mine, is situated in the township of Jaffray five miles east of the town of Kenora.

This company continued development work until September 15th, 1914, when all work was stopped. At that date the underground development stood as follows:—The shaft was 225 feet deep and timbered to 200 feet. On the 55-foot level a cross-cut was driven a distance of 60 feet. On the 75-foot level a cross-cut was driven 27 feet and a sump cut. On the 200-foot level a drift was driven 100 feet and a sump cut.

From 12 to 21 men were employed. Mr. Charles Brent, Kenora, Ont., is president and general manager, and Dr. Frank A. Kendall, 397 Delaware Ave., Buffalo, N.Y., is secretary-treasurer.

Inter-Cities Quarries

At the quarry in Port Arthur owned by the Inter-Cities Quarries Company, Limited, a large tonnage of crushed trap was produced in 1914. Most of the material was used in road work in Fort William and Port Arthur. A quantity of the slate underlying the trap sill was also excavated for the same purpose.

From 85 to 110 men were employed. Mr. W. M. Colquhoun, Whalen Building, Port Arthur, Ont., is manager.

Ignace Granite Quarry

Messrs. Bannerman and Horne operated a granite quarry two miles west of Ignace during the summer of 1914. The granite is chiefly of the grey variety, and is used for paving blocks and building stone. The stone used in the construction of the Port Arthur armoury came from this quarry. The number of men employed during the past season varied from 20 to 60.

The owners of this quarry expect to open a new one in 1915 at Butler Station, west of Ignace, for the manufacture of dressed stone.

Clay and Gravel Pits

As the operation of clay and gravel pits is subject to the provisions of the Mining Act of Ontario, one or more visits were paid to each of the following pits situated in the vicinity of Port Arthur and Fort William:—

Sand-Lime Brick Co., Port Arthur, sand pit.
E. T. Ross, Port Arthur, sand pit.
Alsip Brick and Tile Co., Fort William, clay pit.
Fort William Brick and Tile Co., Fort William, clay pit.
J. Gowanlock, West Fort, clay pit.
Mount McKay Products, Limited, West Fort, shale deposit.
Superior Brick Co., Limited, Rosslyn, clay pit.
Mount McKay and Kakabeka Falls Ry. Co., Paipoonge township, clay pit.

The Mount McKay Products, Limited, West Fort, recently began the manufacture of hydraulic pressed brick on the Indian Reserve at the foot of Mount McKay. The shale used during the past season consisted of talus from the foot of the mountain. Mr. J. Gowanlock is manager.

II.—SUDBURY, NORTH SHORE AND MICHIPICOTEN

Canadian Copper Company

The Canadian Copper Company operated the Creighton, Crean Hill, No. 2 and No. 3 (Frood) mines and Dill quartz quarry in 1914. On August 8th, following the outbreak of war, production was curtailed and all of the above-mentioned properties, with the exception of the Creighton, were closed down for the remainder of the year.

The following general work was done during the year:—

Water mains were laid from Whitson lake to Frood village, Meat-bird lake to Copper Cliff, and Meat-bird lake to Creighton. A storage dam was built on the Spanish river headwaters on Biscotasi lake at a point some ten miles south of Bisco station.

The average number of men in the employ of the company during 1914 was 2,335 up to August, and 1,883 for the whole year.

The officials of the company are:—

President, A. D. Miles.
General Superintendent, J. L. Agnew.
Superintendent of Mines, J. C. Nichols.
Chief Engineer, B. G. Slaughter.
Chief Metallurgist, J. W. Rawlins.
Safety Engineer, E. T. Corkill.

The safety organization of the company, particulars of which have already been published in the accident bulletins of the Bureau of Mines, has established an admirable record for the year. Not a fatality occurred in or about the smelter and roast yards, and only one at the mines. There was also a decided decrease in the number of non-fatal accidents in every department.

Smelting Plant

The Canadian Copper Company's smelter at Copper Cliff worked to capacity until operations were curtailed on August 8th. From this date the reverberatory and Wedge furnaces were closed down, and only two of the six blast furnaces were operated. Early in October two more blast furnaces were blown in, and a fifth was started on January 10th, 1915.

The only construction work performed at the smelter in 1914 was the erection of the steelwork for a new machine shop.

A series of test-runs was made with a Knudson experimental furnace.

Mr. W. Kent is smelter superintendent.

Crean Hill Mine

The three-compartment shaft at the Crean Hill mine of the Canadian Copper Company is now 698 feet deep. It has an inclination of 57 degrees down to the sixth level and 71 degrees below this point. When the mine closed down in August, work had just been started deepening the shaft by raising from the ninth to the eighth level. Development work on the ninth level has to date been done by means of a winze sunk from the eighth level.

Ventilation in this mine is assisted by a fan placed on the fifth level and connected to a 20-inch galvanized iron pipe discharging into the skipway above the fourth level. This ventilating pipe leads down to the ninth level via the winze mentioned above.

The stoping done in 1914 was mainly above the seventh and eighth levels. A small tonnage was also obtained from old stopes above the fifth and sixth levels. The total ore shipped in 1914 amounted to 58,689 tons.

Mr. Charles Collins is superintendent.

Vermilion Mine

The Canadian Copper Company have pumped out this mine and are doing some underground prospecting.

Creighton Mine

The Creighton mine operated steadily in 1914 and still retains the distinction of being the greatest nickel-copper mine in the world. Diamond-drilling has proved that as large ore bodies exist at depth as were found near the surface.

Shipments during 1914 amounted to 455,817 tons. This ore was obtained principally from above the fifth and sixth levels. A considerable tonnage was also extracted from the open pit above the third level, and a small amount from development work on the eighth.

There are two shafts at this mine: No. 1 is 425 feet deep at an angle of 59 degrees; No. 2 is 830 feet deep, and has an inclination of 47 degrees. The No. 2 is the main working shaft, and was being sunk deeper at the end of the year. This shaft has been equipped with two 4-ton skips and a cage capable of carrying 18 men.

The eighth level has been opened 130 feet below the sixth. The seventh level has not been driven, as the method of mining is being changed, and the seventh will be only an intermediate or sub-level for use in development and in drawing from the chutes above.

Starting 5-Compartment Shaft at Creighton Mine.

The reason for making a change in the method of working is that too many chutes are required with the old method. The ore body dips at about 47 degrees. With the new method all openings on the eighth will be cut in the solid. Stopes will be opened up from the foot to the hanging-wall above the tops of the mill-holes; these stopes will be about 60 feet wide. Vertical pillars, about 15 feet wide and extending from foot to hanging-wall, will separate the stopes. These pillars will be continued up to the sixth and down to the lower levels. Manways will be carried up in alternate pillars on the foot-wall side.

The ventilation of the lower levels of the Creighton is assisted by a fan placed on the sixth level. This is connected to a 24-inch galvanized iron pipe extending from the eighth to the fifth level.

A three-drum, electric hoist made by the Denver Engineering Works is now in use at the main shaft. The drums are 4 feet 9 inches in diameter and 4 feet 10 3-8 inches between flanges.

The capacity of the air compressor plant has been increased to 11,000 cubic feet per minute by the addition of a Belliss and Morcom compressor. This is a two-stage machine, 42 inches by 25 inches by 21 inches, with a capacity of 5,000 cubic feet of free

air per minute at 100 lb. pressure and 187½ revolutions per minute. It is driven by a 900 k.v.a., 3-phase, 2,400 volt, 187½ revolutions per minute, auto-synchronous motor (Swedish) with a 22 k.w., 25 to 35 volt, direct-connected exciter.

An innovation has been made by the placing of a crusher below the sixth level. This is a 32-inch by 42-inch, Farrell jaw crusher and is set to deliver a 10-inch product. It is driven by two 100-h.p. motors. This crusher handles all ore obtained from above the fifth level with the exception of the open-pit output. An ore-pass, 8 feet by 10 feet, situated above the crusher, extends from the sixth to the fifth level and from this the ore falls on a 10-inch grizzly. From the grizzly the ore passes into a chute which feeds the crusher. Below the crusher is an ore-pocket holding approximately 400 tons. This pocket discharges into two measuring pockets, each containing a skip-load of ore. These measuring pockets are built of steel plate and are equipped with arc gates.

The average force at the Creighton during the year was 540 men. Mr. Charles Miller is superintendent.

No. 2 Mine

At No. 2 mine, situated at Copper Cliff, ore was mined above the seventh, eighth, ninth, tenth and eleventh levels. The ore shipped in 1914 was 42,114 tons.

The main shaft, which curved from the first level to the surface, was straightened to conform with the dip of the lower part of the shaft, viz., 87 degrees. This shaft now contains a cage and a skip.

The inside shaft, or winze, which starts at the eighth level, was sunk to the eleventh level, and is now 360 feet deep.

Mr. W. J. Hambly was superintendent, with 125 men employed.

No. 3 Mine

The two shafts at No. 3 mine are at the following depths:—the main, or No. 1 shaft, 420 feet; No. 2, 350 feet. An ore-storage pocket was cut below the third level near the main shaft. This shaft is now equipped with skips in two compartments and a two-deck man-cage in a third.

Stoping was carried on above the 200 and 300-foot levels. Above the 200-foot level an open stope extends to a height of 30 to 40 feet above the level. This stope is approximately 375 feet in length and 150 feet in width at the widest point.

To assist the ventilation a 24-inch galvanized iron pipe leads from the surface to the 300-foot level, with branch pipes at the 200-foot level. The fan is placed on surface. A ventilating raise was being driven from the 200-foot level to the surface when the shut-down occurred, and was within 75 feet of the surface at that time.

Shipments in 1914 amounted to 87,688 tons. About 125 men were employed, with Mr. Thomas P. McNamara as superintendent.

Dill Quartz Quarry

The Canadian Copper Company's quartz quarry in Dill township was closed on August 8th, as smelting operations were curtailed on that date, and a considerable quantity of quartz has been stock-piled at Copper Cliff.

About 40 men were employed, with Mr. H. Whitehead in charge.

Mond Nickel Company

The Mond Nickel Company operated the following mines in the Sudbury district in 1914:—Levack, Garson, Kirkwood, Frood Extension, North Star, Victoria and Worthington. The North Star property was abandoned in July; the Frood Extension was closed down in August following the outbreak of war, and the Kirkwood was closed down in December.

A power plant is being built near Nairn on the Spanish river by the Lorne Power Company, a subsidiary of the Mond Nickel Company. The head ranges from 27 to 31

feet, and about 4,800 h.p. will be developed. Two vertical high-speed water-wheels will develop about 2,400 h.p. with 30-foot head. These wheels will approach 90 per cent. in efficiency. They will drive two generators, 1,600 k.v.a. each, running at about 100 revolutions. The plant is so built that a third unit can be put in if required. The plant also includes one vertical exciter, 180 h.p., water-wheel driven, and a motor-generator set.

The local officials of the Mond Nickel Company are:—

Manager, C. V. Corless.

Mines superintendent, O. Hall.

Smelter superintendent, J. F. Robertson.

Coniston Smelter

The Mond Company operated the smelter at Coniston steadily in 1914 with an average of two furnaces and two converters in blast. The third furnace was not blown in. A Fink experimental furnace was set up in the smelter and experiments are being conducted. In the sintering plant two Dwight-Lloyd units are in operation.

The following additions were made during the year:—Ore bin capacity was doubled. Transformer capacity was increased by 600 k.w. A low track with grizzly above it has been put in at one end of the converter floor for the handling of ladle skulls and other scrap. A carpenter shop, a machine and blacksmith shop, and a permanent warehouse were built. A Connellsville blower with a capacity of 400 cubic feet of air per revolution was added. A transmission line is being built from the smelter to Garson mine. This will connect the smelter with the Wabageshik and Nairn plants for flexibility.

Mr. J. F. Robertson is smelter superintendent.

Levack Mine

The Levack mine, owned by the Mond Nickel Company, is situated in lots 6 and 7, concession II, Levack township. Diamond drilling has proved the presence of a large body of ore near the contact of the norite and gneiss.

A branch railway, five miles long, leads to the mine from Levack station on the C.P.R. main line, 25 miles west of Sudbury. This spur is owned by the mining company.

An electric transmission line, 28 miles long, delivers power from the Wabageshik plant of the Nairn Power Company to the mine at 44,000 volts. The power-house at the mine has a brick exterior and cement Hyrib interior. It contains: an 1,800-cubic foot Rand, compound, duplex compressor, belt-driven by a 300-h.p. motor; a 3,200-cubic foot Ingersoll-Rand, Rogler valve, compressor, direct-driven by a 550-h.p. synchronous motor. In a separate building a 1,100-cubic foot Rand, steam or electric, compressor will serve as a reserve. Three General Electric water-cooled transformers are set up in a wing off the power-house.

The hoist-house is of the same type of construction as the power-house. It contains an Allis-Chalmers hoist with two cylindrical drums, 7-foot diameter and 6-foot face. This is capable of handling a 4-ton load in the skip, and is driven by a specially designed Allis-Chalmers motor of 250 h.p. A cage hoist is not being put in at present.

The rock-house is nearly completed and the ore-handling equipment is being set up. Considerable storage capacity is provided above two Hadfields jaw crushers. The latter have an opening of 18 inches by 24 inches, and are automatically fed by a short Stephens-Adamson belt, from which rock will be picked.

Magazine, thaw-house, fuse-house and heating-room are built. The three latter are of cement-plaster construction.

A five-compartment shaft, pitching to the southeast at an agle of 65 degrees, was begun in April, 1914, and was 190 feet deep at the end of the year, with the timbering completed to 75 feet. A concrete collar extends to a depth of 12 feet, and from the bottom of the collar to 75 feet concrete has been poured behind the timbers. The first level station has been cut at 168 feet, measured on the incline, and a drift

run 60 feet southwest. This drift will eventually connect with an escapement shaft which now measures 150 feet at an angle of 53 degrees. The levels below the first will be driven at vertical intervals of 100 feet.

Shipments amounting to 16,712 tons were made during the summer from an open cut 300 feet south, and from another about a quarter of a mile northeast of the main shaft.

Mr. F. J. Eager is superintendent. From 125 to 200 men were employed in 1914.

Garson Mine

In 1914, as in the preceding year, the Garson mine was the principal producer of the Mond Nickel Company. The total ore hoisted amounted to 177,379 tons. It was obtained from above the first, second, third and fourth levels, both northeast and southwest of the shaft. The fifth level is still used only as a loading station for the ore from the ore-pocket below the fourth level. The sixth level is being developed southeast of the shaft, and a raise from the sixth to the fourth levels is almost completed.

The only construction work done on the Garson during the year consisted in building a club-house for the staff.

The number of men employed at this mine varied from 340 to 420. Mr. A. L. Sharpe is superintendent.

Kirkwood Mine

The Kirkwood mine of the Mond Nickel Company operated until December 17th, 1914, when it was closed down.

There are two shafts at this mine. The west or main shaft is 110 feet deep; it has three compartments to the 80-foot level and is timbered to that point. Below that it is of two-compartment size. The east shaft has been sunk to a depth of 75 feet to prospect a separate ore body.

Shipments were made from the western ore body, stoping being carried to a depth of 130 feet. Ore hoisted amounted to 32,760 tons. A Trenton Iron Works aerial tramway, 9,000 feet long, driven from the Garson rock-house shafting, delivers the ore to the Garson.

Power was obtained from a 5-inch air line from Garson mine.

Mr. J. R. Thoenen was superintendent, with 115 men employed.

Frood Extension

The Frood Extension mine operated until August 15th, 1914, when all work was stopped owing to conditions following the outbreak of war.

The vertical, four-compartment shaft, 21 feet by 7 feet, is 1,005 feet deep and timbered to 917 feet.

On the first, or 400-foot, level a drift extends southeast 230 feet. From the end of this drift a raise extends to the surface, and a winze has been sunk to a depth of 170 feet below the level.

On the second, or 750-foot, level a drift runs southeast 220 feet. Near the end of this drift a raise has been started to connect with the winze from the first level. A winze has also been started near the end of this drift, and is 70 feet deep.

On the third, or 900-foot, level the station has been cut and 210 feet of drifting done southeast of the shaft.

The power-house has been completed and contains:—

One 23-inch and 23-inch by 48-inch Nordberg geared hoist with two drums, 10 feet in diameter with 78-inch faces. It is equipped for either air or steam. Provision has been made whereby a third clutched drum for hoisting men may be added when desired.

One 2,800 cubic foot Nordberg air compressor.

One 1,750 cubic foot Rand air compressor, belt-driven.

Construction of the rock-house and dry was in progress when the shut-down occurred.

Mr. J. H. Stovall was superintendent, and from 100 to 145 men were employed.

North Star

Stoping at the North Star mine in 1914 was confined to the ground above the second level, both east and west of the shaft. The shaft was sunk to a depth of 375 feet, the third level station cut at 350 feet, and drifts run east 90 feet and west 40 feet. As the results were not sufficiently encouraging the property was closed down on July 18th, the machinery removed and the buildings torn down.

Mr. J. H. Smeltzer was the resident superintendent, with a force of 42 men. Ore hoisted during the year amounted to 18,763 tons.

Victoria Mine

The three-compartment vertical shaft of the Victoria mine, owned by the Mond Nickel Company, is the deepest in the Province. It measured 2,176 feet at the end of 1914, with sinking still in progress.

The ore bodies consist of two pipe-like masses situated east of the shaft. They have a dip of some 70 degrees to the southeast. The ore, therefore, lies farther from the shaft as the depth increases. The eastern ore body has not been found below the 11th level (1,148 feet), but the western body has been proved to continue to the 15th level (2,025 feet), where it was encountered 567 feet east of the shaft and is now being developed. The exact dimensions of the latter ore body on this level are not yet known, but enough work has been done to prove it a valuable one.

The levels below the ninth are driven at intervals of 210 to 220 feet. Shrinkage is used for the lower part and underhand stoping for the upper part of each block.

The ore is hoisted in 18-cubic foot cars on single-deck cages. A new hoist is now on order from the Nordberg Manufacturing Company. It will have two 10-foot drums with 6-foot 6-inch faces to carry 1¼-inch cable.

A new change-house has been built of cement-plaster and metallic lathing.

Mr. W. J. Mumford is superintendent, and employed from 120 to 175 men during the year. Ore hoisted amounted to 59,942 tons.

Worthington Mine

Construction work at the Worthington mine of the Mond Nickel Company was completed and the plant put in operation on May 1st, 1914. The company now has 30 houses on the townsite.

The three-compartment shaft was 440 feet deep at the end of 1914, with sinking in progress and the timbering completed to 400 feet. The inclination of this shaft is 61 degrees for the first 338 feet and 65 degrees below. Each of the two hoisting compartments contains a cage, below which a 72-cubic foot skip is suspended.

Levels have been driven at 170 and 270 feet vertical depth. On the first level drifts extend 380 feet east and 180 feet west of shaft; on the second level, 240 feet east and 340 feet west. Stopes have been opened above each of these drifts.

A small shaft 100 feet deep, has also been sunk beside a deposit from 6 to 22 feet wide, situated 3,000 feet northeast of the main shaft. Stoping has begun on this ore body.

In 1914, 42,518 tons of ore were hoisted at this mine. Mr. R. N. Palmer is superintendent, and has 270 men employed.

British America Nickel Corporation, Limited

The work done by the British America Nickel Corporation, Limited, in 1914 was confined to the development of the Murray mine, which property was closed down on August 31st. About 50 men were employed.

The three-compartment shaft, which has an inclination of 36 degrees, is 700 feet deep. Stations have been cut at 150 feet, 300 feet and 400 feet, and a pocket cut between the two latter levels.

The local officials of the corporation are J. A. Holmes, manager, and E. Hibbert, superintendent of mines.

Long Lake Gold Mine

The gold mine and mill of the Canadian Exploration Company, Limited, situated near Long lake on Timber Berth No. 9, operated continuously in 1914.

The ore body consists of an elliptical mass of quartzite, carrying considerable mispickel and pyrite. The contact between the ore body and the barren quartzite surrounding it is not well defined.

The underground development is as follows:—The shaft is 225 feet deep, with two compartments to the first level and three compartments from the first to the second. The levels have been driven at 80 and 180 feet. An open-pit extends to the 80-foot level. The ore mined in 1914 came from both levels. A winze is now being sunk below the second level.

The mill contains 20 stamps and a cyanide plant. Changes have been made in the mill so that the capacity has been increased from 2,200 to from 4,200 to 4,400 tons per month.

The officials of the company are:—Managing director, George E. Drummond; superintendent, R. W. Brigstocke.

The post office for the mine is at Naughton, Ont., on the Sault branch of the C.P.R.

The employees numbered 110.

Moose Mountain Iron Mine

No. 1 mine of Moose Mountain, Limited, at Sellwood, Ont., closed down on June 1st, 1914, owing to the lack of demand for iron ore. The shaft is now 170 feet in depth measured along the incline (62 degrees). Two levels have been driven, one at 100 feet and one at 150 feet. Work on the second level was stopped when the ore body was reached.

After the mine was closed down, the crushing plant was run during June, July and August on rock from the dump. Two hundred and fifty tons a day were shipped to Sudbury for road ballast.

No. 2 mine was not operated.

The treatment of the ore at this property was described some time ago in the technical journals, but as important changes have recently been made in the process, another short description may be of interest.

The ore from No. 1 mine runs 45 per cent. iron. It is crushed to one inch and raised to 54 per cent. by magnetic concentration in No. 1 mill. The products from this mill are:—Concentrates with no dust, dust and middles, and road ballast with no dust. It requires 1 7-10 tons of crude ore to produce one ton of screened concentrates running 54 per cent. The dust and middles, constituting about 12½ per cent. of the total ore treated, run about 46 per cent. iron, and are sent to No. 2 mill for further treatment.

The No. 2 mill was built to treat both the ore from No. 2 mine, which contains a lower percentage of phosphorus than that of No. 1, and also the above-mentioned dust and middles from No. 1 mine. The ore is first crushed to 3 or 4 inches in a 36-inch by 48-inch Buchanan, all-steel, jaw crusher with a specially deep frame. It is then hoisted up an incline in a skip to a 2,500-ton steel bin. From this point to the final magnetic separators the mill consists of five units. The ore flows by gravity from the bin into No. 2 McCully gyratory crushers set for large product. Thence it passes into Hardinge, 6-inch by 16-inch ball mills, making 29 revolutions per minute and using 5-inch chrome steel balls. A magnetic separator then removes practically all of the gangue and a Hardinge pebble mill carries the grinding to 100 mesh. The ore is then delivered to the final separator, which gives a concentrate analyzing 64 per cent. iron and from .025 to .020 per cent. phosphorus. This concentrate, carrying approximately one ton of water to one ton of ore, goes to two Dorr classifiers in which the water is reduced to 21 per cent.

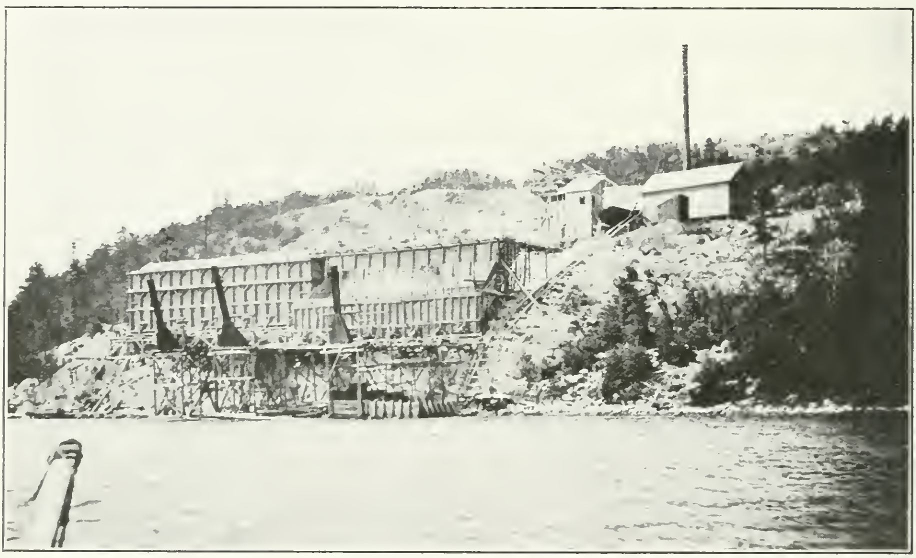
The concentrate drops into a removable steel mould subdivided by steel partitions into 32 compartments. The mould rests on top of a steel car, 70½ inches wide and 76¼

inches long, and has a taper of ⅛ inch to the foot, so that it may be lifted off the cars and leave the briquettes intact. The moulds are subjected to a mechanical jarring action which renders the material more compact and diminishes the water content to 8 per cent. The mould is automatically removed before the car enters the kiln. Each car carries 6,400 pounds of briquettes.

There are two kilns each 220 feet long with an arch of 9 feet 6 inches radius. The briquettes near the sides of the kiln are 18½ inches high; those at the centre of the arch are 23 inches high. Each kiln contains 34 cars, one being admitted every 20 minutes, so that each car is in the kiln for 11⅓ hours. The fuel used is producer gas.

From the kilns the briquettes, each weighing 200 lb., go to a No. 3 Gates gyratory crusher. The crushed material passes through a long revolving screen with ⅛-inch apertures. The oversize is loaded into railway cars and the undersize, constituting 5 per cent. of the briquette, is returned to the Dorr classifiers.

A concrete dam was built by the company across Taylor Lake creek, a tributary of the west branch of the Vermilion river. This dam is 10 feet wide on the crest so



Quartz quarry of Willmott and Company at Killarney.

as to serve as a roadway, and 110 feet long. It gives a depth of from 16 to 17 feet of water above the stream bed. It was built for the purpose of supplying water through a 10-inch main, 1,300 feet long, to No. 2 plant for the condenser of a 1,000-h.p. Westinghouse-Parsons steam turbine. The latter is to serve as an emergency plant.

When the mine was operating, approximately 216 men were employed. Mr. Fred. A. Jordan is manager, and Mr. F. C. Rork mine superintendent.

Quarries

College of Sacred Heart

David Servis opened a small quarry on the property of the College of the Sacred Heart, Sudbury. Building stone was produced for the construction of the Sudbury post office. Twelve men were employed.

Willmott and Company

Willmott and Company operated a quartz quarry during the season of navigation on the north shore of Georgian bay about three miles east of Killarney.

The power plant comprises a Jenckes 150-h.p. return tubular boiler, a 15-inch Jenckes engine to drive the crushers and a hoist for handling coal and other supplies.

The quartz is passed through a 10-inch by 20-inch Farrell-Bacon jaw crusher which feeds an 8-foot trommel with 3-inch perforations. The oversize passes to a No. 3 Gates gyratory crusher; the undersize to the storage bins. These bins have a capacity of 2,400 tons, and discharge upon 24-inch Stephens-Adamson belt conveyors. The latter deliver the product to steel ore chutes which discharge into the hatches of the steamer. A 2,400-ton cargo is loaded in ten hours.

The quartz is shipped to the Electro Metals Company, Limited, of Welland, Ont., for the manufacture of ferro-silicon. The shipments are said to analyze over 98 per cent. silica.

The officials of the company are: President, Alex. Longwell; manager, Geo. W. Rayner, 404 Lumsden Building, Toronto. At the time of last inspection 28 men were employed on the property, with Mr. Dan Chisholm in charge.

Martin International Trap Rock Company

The Martin International Trap Rock Company, Limited, operated their trap quarry at Bruce Mines until the middle of August, when it was closed down. At the time of the last inspection (in August), 52 men were employed. Mr. S. B. Martin, Bruce Mines, Ont., is manager.

It is understood that a reorganization of the company is in progress.

Clay and Gravel Pits

The following clay and gravel pits near Sudbury and Sault Ste. Marie were visited:

The Evans Company, Sudbury, gravel pit.

Robert Martin, Sudbury, clay pit.

Sudbury Brick Company, Sudbury, clay pit.

Northern Brick Company, Copper Cliff, clay pit.

McPhail and Wright Construction Company, Sault Ste. Marie, gravel pit.

McPhail and Wright Construction Company, Searchmont, gravel pit.

Jas. Elliott and Sons, Steelton, clay pit.

Lethbridge Brick Company, Limited, Steelton, clay pit.

Algoma Brick and Tile Company, Limited, Steelton, clay pit.

Algoma Steel Corporation

The Algoma Steel Corporation, Sault Ste. Marie, Ont., operated their No. 1 and No. 2 blast furnaces the whole of 1914. The largest furnace, No. 3, was closed down on September 1st, and was not operated the remainder of the year. Nos. 1 and 3 furnaces produced principally bessemer pig, while No. 2 ran on basic.

In addition to enlarging and operating the plant at Magpie mine for the roasting of siderite, the Corporation also built an experimental plant at Steelton to investigate the Greenawalt process of roasting. A series of experiments was conducted, using the latter process to roast Michipicoten siderites and also to sinter blast furnace flue dust. These experiments are believed to have yielded promising results.

The officials of the Corporation are:

President and general manager, J. Frater Taylor.

General Superintendent, Charles E. Duncan.

Superintendent of blast furnaces, James H. Bell.

Mr. Samuel Hale was general manager until the latter part of the year, when he resigned, his duties being assumed by the president.

Approximately 2,100 men are employed by the Corporation at Steelton when working to capacity.

Magpie Mine

The Magpie mine of the Algoma Steel Corporation is now on a producing basis, the shipments in 1914 amounting to 98,070 tons of roasted ore. Both mine and roast plant were closed down on October 31st, owing to the condition of the steel market. It is expected that work will be resumed in the spring of 1915.

The four-compartment shaft at this mine is now 345 feet deep. Stopes have been opened on the first and second levels, both east and west of the shaft. On the third level the station has been cut and 85 feet of cross-cutting done. The ore body had just been encountered in the face of the latter cross-cut when work was stopped.

The new roast plant was put in operation in May, and as it is different from the experimental unit in which the original experiments were made, a brief description is given below.

The ore, hoisted in 80-cubic foot skips of the Kimberley type, is dumped into a No. 8 Austin gyratory crusher. It then passes to a grizzly, the oversize going to two No. 5 Austin crushers and thence to a conveying belt, while the undersize passes directly to said belt. This conveyor elevates the ore to a horizontal belt, which carries a movable trip, so that the ore may be discharged into any one of six 5,000-cubic foot steel-bottomed stock bins.

The kilns are six in number, each 8 feet in diameter and 125 feet long, inclined at one-half inch to the foot. They are lined with a special 9-inch firebrick. Special shapes narrow the feed end to 4 feet 6 inches. Each kiln is driven by a 35-h.p. variable speed a.c. motor.

At the upper end of the kilns concrete dust chambers are built. Through these the waste gases pass to concrete stacks, one for each kiln. These stacks are from 95 to 105 feet in height.

The lower end of each kiln is covered by a removable hood, similar to those used in cement plants.

After the ore passes through a kiln it is conveyed to the stockyard by a rotary tube passing through the ore-bridge walls. These tubes are 4 feet 6 inches in diameter and 44 and 46 feet in length. They are lined with 4-inch firebrick.

The fuel used in the kilns is powdered coal. The coal is stored in part of the stockyard and is delivered to a hopper by the ore bridge. It is then fed by a reciprocating feeder to a pair of iron rolls with cast teeth. Thence it is elevated on a link-belt conveyor and passes through a weighing device to a 20-ton steel storage bin. A reciprocating feeder delivers it to a 3-foot by 32-foot rotary dryer, inclined at three quarters of an inch to the foot. A second dryer is being put in. An elevator then takes the powdered coal to a 12-inch screw conveyor, which supplies a stock bin for each kiln. These bins each contain 22 tons of coal. At the bottom of each bin is a 4-inch standard furnace feeder, governed by a speed changer. These feeders deliver the coal to a 9-inch blowpipe entering the lower end of each kiln. A No. 10 Sturtevant blower furnishes the necessary air.

Mr. A. Hasselbring is in charge of the property. From 210 to 230 men were employed.

Helen Iron Mine

The Helen iron mine of the Algoma Steel Corporation worked steadily in 1914, notwithstanding the unsatisfactory conditions prevalent in the markets for iron ore. The ore mined was obtained from the 4th, 6th, 7th and 8th levels.

Considerable pyrite was also shipped. As much of the pyrite in this mine occurs in the form of a fine mud, consisting of a mixture of pyrite and hematite, a small concentrating plant was built in the spring to ensure a cleaner pyrite product. The machinery consists of a Mitchell crusher, a set of rolls and two No. 6 standard Wilfley tables.

About 110 men are employed, under the superintendence of Mr. G. R. McLaren.

Josephine Iron Mine

The Josephine iron mine, situated on the Michipicoten branch of the Algoma Central railway and owned by Alois Goetz and associates, was leased by the Algoma Steel Corporation in 1913. The Corporation put down five diamond-drill holes, completing the work in August, 1914. Since that date no further work has been done.

Iron Pyrites

Madoc Mining Company

The Madoc Mining Company, a subsidiary of the General Chemical Company of 25 Broad Street, New York, has leased the Goudreau pyrite claims from the Algoma Steel Corporation. These claims are situated two miles east of Goudreau station on the Algoma Central railway in township 27, range XXVI. The deposits were partially prospected by diamond-drilling and test-pitting between the years 1902 and 1909. The Madoc Mining Company began work on the property in 1913 and have put down some 60 diamond-drill and shot-drill holes. A cargo of 3,000 tons was mined in 1914 and shipped down the Great Lakes, via Michipicoten harbour. A contract has been let for the construction of a railway spur from the main line to the mine—a distance of two miles—and it is expected that regular shipments will be made as soon as construction work on the railway and plant is completed.

Mr. J. A. Battle, Jr., is superintendent.

Morrison Pyrite Claims

The Morrison pyrite property consists of 12 mining claims in the southern part of township 27, range XXVII, district of Algoma. They lie about five miles northeast of Goudreau station on the Algoma Central railway and about two miles northeast of the Goudreau pyrite claims. The Algoma Steel Corporation drilled the ore body under option in 1914, putting down 19 diamond-drill holes. Since the drilling was completed no further work has been done.

III.—TIMISKAMING

Cobalt and Vicinity

The silver mining industry of Ontario has its head and centre at Cobalt, and a brief description of the work done at the properties operated in 1914, whether productive or not, is given hereunder.

Aladdin

The Aladdin Cobalt Mining Company operated the old Silver Queen mine with a force of 15 men during the first half of the year. The mine was closed down August 15th.

The development consisted of 300 feet of work, 75 feet of which was raising, and the rest drifting. Forty tons of high-grade ore were shipped and 1,161.3 tons of ore were milled at the Northern Customs concentrator. The production was 60,000 oz. of silver.

Capt. Conrad Jorgensen is president; Mr. J. A. McVichie is manager.

Alexandra

The Canadian Gold and Silver Mining Company pumped out the Alexandra mine in April, and operated with one drill for about three months. Between 130 and 140 feet of drifting was done on the 300-foot level, and a raise was put up for 20 feet at a point 150 feet east of the shaft.

Bailey

The Bailey Cobalt Mines, Limited, operated during the first five months of the year with a force of 16 men. The work done consisted of 280 feet of drifting, 254 feet of cross-cutting, 75 feet of raising, and the cutting of a station at the fifth or 280-foot level. With the exception of 100 feet of cross-cutting on the fourth level, this work was done on the fifth or lowest level.

Mr. E. A. Benson was succeeded as president by Mr. John L. Woods shortly before the mine closed down. Mr. Floyd Weed is superintendent.

Cobalt Lake before dewatering

Cobalt Lake, June, 1915

Beaver

The Beaver mine, situated on the north half of the northwest quarter of the north half of lot 1 in the third concession of Coleman, is owned and operated by the Beaver Consolidated Mines, Limited, which have an authorized capital of 2,000,000 shares of a par value of $1.00 each. The officers are as follows: Frank L. Culver, president and general manager; C. C. James, vice-president; H. E. Tremain, secretary-treasurer.

Following is the record of development and stoping for the year:

Drifting	3,094.0 feet
Cross-cutting	1,393.0 feet
Sinking	100.7 feet
Raising	507.0 feet
Total	5,094.7 feet
Stoping	5,807 cubic yards

A station was cut at the 900-foot level.

During the year the mill treated 26,724 tons, producing 347.95 tons of concentrates, which contained 415,707.86 oz. of silver.

The total silver production during the year was 900,000 oz., an increase of 137,301 oz. over the best previous production of the mine.

One dividend amounting to $60,000 was paid during the year.

Buffalo

This mine, situated on the townsite of Cobalt, is owned and operated by the Buffalo Mines, Limited, which have an authorized capital of $1,000,000, the shares having a par value of $1.00.

The officers of the company are as follows: Mr. Chas. L. Denison, president; Mr. Robt. W. Pomeroy, vice-president; Mr. Geo. C. Miller, secretary-treasurer; Mr. Tom R. Jones, general superintendent.

The high-grade and low-grade mills were closed down for about three months from August 15. During this period development work underground was carried on. This reduced the force from 260 men to 70. At the end of the year about 200 men were employed.

Casey-Cobalt

The Casey-Cobalt Silver Mining Company, a limited company with an authorized capital of $100,000.00, operated their property on the southeast quarter of the S. half of lot 5, in the 1st concession of Casey township, about 9 miles northeast of the town of New Liskeard.

The following compose the board of this company: President, W. R. P. Parker; vice-president, J. P. Watson; G. M. Clark, Captain R. E. G. van Cutsem, and Graeme Watson.

Mr. John W. Shaw is mine manager, employing about 200 men.

During the period covered by the report of this company, up to December 31st, 1914, operations in the mine and mill have been vigorously prosecuted, the total footage being 5,052 feet.

A shaft has been sunk and equipped on the East Casey claim, to a depth of 350 feet, with stations at 275 and 335 feet.

Chambers-Ferland

The Chambers-Ferland Mining Company, which is controlled by the Aladdin Cobalt Mining Company, operated during the year with a force of 35 men.

The officers of the company are as follows: Capt. C. Jorgensen, president; Mr. C. A. Richardson, vice-president; Mr. Alex. Fasken, secretary-treasurer; Mr. J. A. McVichie, manager.

The development for the year consisted of sinking No. 4 shaft from 304 feet to a depth of 431 feet, and the establishment of levels at 200, 350 and 420 feet; 725 feet of cross-cutting on the 350-foot level; 120 feet of tunnelling to the shaft at the 75-foot level; 25 feet of raises and winzes in No. 4 shaft, and the same amount in No. 1 shaft.

10,830 tons of ore were milled at the Northern Customs concentrator.

Colonial

The Colonial Silver Mines, Limited, worked one drill for the first seven months of 1914; seven men were employed. The mill was operated under lease by the Right of Way Mines up to September 15th, when it was closed.

Columbus

A contract was let for shaft sinking on the Columbus property, and the shaft deepened from 320 to 385 feet. Mr. John McLeod was the contractor.

Cobalt Comet

The Cobalt Comet mine is situated on the southwest quarter of lot 2, con. 5, and the northwest quarter of con. 4, in the township of Coleman. The property is operated by the Cobalt Comet Mines, Limited, which has an authorized capital of 1,000,000 shares of a par value of $1.00 each. The capital stock of the company is held by the Caribou-Cobalt Mines Company, with an authorized capital of $1,000,000.

The low-grade ore is treated by the Dominion Reduction Company, and high-grade ores are shipped. Gross production for the year amounted to 727,671 ounces; 2,111 feet of development was done during the year.

Mr. E. V. Neelands is manager, and about 50 men are employed.

Coniagas

The Coniagas Mines, Limited, having an authorized capital of 800,000 shares of a par value of $5.00, own and operate the Coniagas mine, consisting of 40 acres on the townsite of Cobalt, and also own the issued capital stock of the Coniagas Reduction Company, Limited. The board of directors is as follows: R. W. Leonard, St. Catharines, president and general manager; Alex. Longwell, Toronto, vice-president; R. P. Rogers, Cobalt; F. J. Bishop, Brantford; Welland D. Woodruff, St. Catharines.

During the year $1,640,000.00 was paid in dividends, and the total dividends to date amount to $7,000,000.00 The total shipments of silver aggregate over 20,000,000 oz., and the ore reserves are estimated by Mr. Rogers at 11,904,000 oz.

The total silver shipments from the mine during the year amounted to 2,497,394.68 ounces, which was contained in 484.88 tons of mine ore, and 688.44 tons of concentrates. This ore was mined and concentrated at a net cost of 12.444 cents per ounce, as compared with 8.776 cents for the previous year. The cost of shipping, smelting, refining and marketing amounted to 3.585 cents per ounce of silver, as compared with 4.321 cents for the previous year. The average price received per ounce of silver was 56.75 cents, as compared with 60.55 cents for the previous year.

The mill ran 98 per cent. of possible time, treating 54,522 tons, or an average of 2.93 tons per stamp per 24 hours. The mill heads averaged 24 ounces per ton; the average of the general tailings was 4.21 ounces. The high grade concentrates shipped totalled 496.4 tons, and the low grade slimes 251.8 tons. These averaged 2,030 ounces per ton, and 151 ounces, respectively.

During the year operations were started at the No. 4 shaft, situated opposite the Cobalt post office. A shaft-house and hoist-house were erected, and the shaft completed to the 4th level.

Work done to date and work done during the year ending October 31st, 1914:—

—	Total to Oct, 31st, 1914	Total to Oct. 31st, 1913	Work done during 1913–14
Shaft sinking, feet	802	610	192
Drifting "	15,982	14,939	1,043
Crosscutting "	6,805	5,899	906
Winzes "	519	441	78
Raises "	895	819	76
	25,003	22,708	2,295

—	Tons removed since beginning of operations to Oct. 31st, 1914	Tons removed to Oct. 31st, 1913	Tons removed during 1913 and 1914
Crosscutting and waste	35,293	27,914	7,379 barren rock
Drifting	52,846	49,271	3,575 pay rock
Stoping	249,395	198,592	50,803 "
Open cutting	4,780	4,780	
Shaft sinking	2,554	2,265	289 barren rock
Winzes and raises	4,151	3,602	549 pay rock
	349,019	286,424	62,595

Crown Reserve

The Crown Reserve Mining Company, Limited, with an authorized capital of 2,000,000 shares, par value $1.00 each, own and operate the Crown Reserve mine at Cobalt, work the Silver Leaf mine under lease, and, in conjunction with the Kerr Lake Mining Company, operate the Drummond Fraction. They also own sixty per cent. of the entire capital stock of the Porcupine-Crown mine.

The officers of the company are as follows: Col. John W. Carson, president; W. I. Gear, first vice-president; J. G. Ross, second vice-president; Jas. Cooper, secretary-treasurer; S. W. Cohen, general manager.

The production during the past year amounted to 1,425,320 ounces of silver of a gross value of $740,092.70, or an average value of 51.92 cents per ounce. The dividends paid in 1914 amounted to $424,515.36.

During the year 31,347 tons of ore were milled by the Dominion Reduction Company, from which 467,757 ounces of silver were recovered.

A new vein, No. 33, has been discovered during the year in the eastern portion of the property while cross-cutting to the diabase. Several minor veins, for the most part branches from the more productive veins 17 and 24, have been developed on the 100-foot level. A rather promising lead has also been opened up on the 75-foot level on the Silver Leaf property.

A summary of the mine development is as follows:

	To 1914.	1914.	Total.
Sinking and raising	2,510 feet.	269 feet.	2,779 feet.
Drifting	9,779 "	1,569 "	11,347 "
Crosscutting	9,855 "	2,218 "	12,073 "
Total	22,143 "	4,056 "	26,199 "

Stoping in cubic feet, 1914	469,552
Stoping in square feet, 1914	65,092
Tonnage broken	40,842

Drummond Fraction

The Drummond Fraction, which is owned jointly by the Crown Reserve and the Kerr Lake Mining Companies, operated continually during the year with the exception of seven weeks at the outbreak of the war. Prospecting work has been carried on at the 100-foot level. One small vein was discovered, but has not proved ore-bearing. The production for the year has been mostly from No. 1 vein; this totalled 134,256 ounces of silver, of which 95,771 ounces was won from mill ore, and 38,485 ounces from high grade.

The development footages for the year were as follows: Drifts, 192 feet; cross-cuts, 558 feet; raises, 38 feet; total, 788 feet.

Mr. M. C. H. Little is manager, employing about 25 men.

Gould

The Cart Lake Silver Mines, Limited, operated the Gould lease on Cart lake during 1914, under the management of J. G. Sipprell.

The production for the year amounted to 150,000 oz. This ore came from the extension of the Seneca-Superior vein, which was found on the Gould lease. A winze on this vein was sunk from the 200-foot level to a depth of 135 feet. No. 2 shaft was sunk to a depth of 195 feet and a station cut at the 185-foot level. From this level 394 feet of drifting and cross-cutting was done. No. 3 shaft, on the east side of the lake, was sunk to a depth of 34 feet.

The total footage of development work during the year was 1,003 feet.

Hudson Bay

The Hudson Bay Mines, Limited, own 340 acres in Coleman township, and, in addition to some non-producing properties, 540,000 shares of the 940,312 issued shares of the Dome Lake Mining and Milling Company.

The officers of the company are as follows: Geo. Taylor, president; A. A. McKelvie, vice-president; S. S. Ritchie, T. McCamus, D. M. Ferguson, J. J. Grills, C. L. Sherrill, directors; F. L. Hutchinson, secretary-treasurer; A. H. Brown, manager.

The ore reserves at No. 1 mine were worked out in June, and that property was closed down. The production for the ten months of the company's fiscal year ending August 31st, 1914, was 393,360 ounces of silver, of a net value of $196,435.92. The total production since the mine was opened in 1907 has been 5,604,168 ounces of silver of a net value of $2,965,523.

The mill treated 18,581 tons of ore, averaging 19.5 ounces, from which were recovered 458.9 tons of concentrates containing 391,887.4 ounces, the ratio of concentration being 40 to 1.

The mine produced 20.9 tons of high grade ore containing 55,876.27 ounces of silver, and 51.53 tons of second grade ore, containing 24,654 ounces.

Exploration work has been carried on at No. 2 mine without as yet obtaining any ore. Two additional levels were opened up at this mine at depths of 230 and 330 feet in addition to the sinking, the cross-cut on the 230-foot level was driven 65 feet across the Cobalt Lake fault to the conglomerate and 363.5 feet of cross-cuts were driven in this formation up to the close of the company's fiscal year.

Between this and the end of 1914, one hundred feet of drifting was done in the Keewatin on the 330-foot level, and a raise put up 60 feet at a point 80 feet from the shaft.

Sixty men were employed at No. 1 mine, and ten at No. 2.

Kerr Lake

The Kerr Lake Mining Company has an authorized capital of 600,000 shares of a par value of $5.00 each. The officers of the company are as follows: Mr. William G. Nickerson, president; Mr. Samuel A. Lewisohn, vice-president; Mr. E. H. Westlake, secretary-treasurer; Mr. Robert Livermore, manager.

The underground development during the year closing August 31st, 1914, was as follows:

	Development.	Stoping. Square feet.
Drifting	3,310.0 feet.	
Cross-cutting	1,747.0 "	
Raising	285.0 "	
Sinking	57.5 "	
Stoping	......	36,767
Side-cutting	......	333
Total	5,399.5 "	37,100
Trenching (mostly in lake basin)	2,513.0 "	
Total development to date	40,062.0 "	

The new discoveries during the year consisted partly of new veins and partly of extensions to known ore bodies. Developments increased the silver contents of the Main East and Fleming veins, and Lake veins Nos. 1, 2 and 3, and No. 218 were added to the reserves.

The most important discovery during the year was of the Lake vein No. 3, which was first exposed on surface after the mud level had been sufficiently lowered in the lake basin. It comprises a system of veins lying north of the Main East and connecting that vein with the Fleming. It lies in the north central area of the property which was not hitherto prospected. Although the main lead is comparatively narrow, it has a high average silver content, and has been exposed for over 200 feet. It has been drifted on for 240 feet at the 140-foot level.

Of the 18,862 tons treated at the mill of the Dominion Reduction Company, 2,552 tons were taken from the dumps. The yield from mill ore was 632,023 oz. of silver. Altogether 1,828,424 oz. of silver were produced, and $600,000.00 paid in dividends during the year. The dividends to date amount to $5,200,000.00.

The mining cost was $5.09 per ton of rock hoisted, or 12½ cents per oz. of silver produced. Shipment and treatment charges were 11.6 cents per oz.; and the total, including administration charges, just under 25 cents per oz.

In May the Kerr lake draining operations were resumed, and by the end of August the scow rested on bed rock near the centre of the basin at a depth of 80 feet below the original water line. The work this season consisted almost entirely of pumping the semi-liquid mud which was left after the water had been pumped out. This was done without difficulty until the drying out of the exposed surface made it necessary to instal a simple hydraulic apparatus to sluice down the loose material and to cut a way through the underlying bed of clay to bed rock. This consists of small monitors mounted on the scow and others on tripods for use at some distance away from the scow. An auxiliary 1,000-gallon turbine pump was installed in the Giroux Lake pump house to supply extra water through a six-inch line to the nozzles. With this apparatus satisfactory results have been obtained.

The working force of 145 men was reduced about one-third during the latter part of the year.

La Rose Consolidated

The La Rose Consolidated Mines Company, Limited, operate the following mines. La Rose, Lawson University, Princess, Fisher-Eplett and Violet. Mr. D. Lorne McGibbon is president, and Mr. R. B. Watson, general manager.

The production during 1914, was 1,368,247 ounces of silver of a net value of $637,556. The cost of production was 37.2 cents per ounce, and the net selling price 53.92 cents. The net profit was $217,979.00, or 30 per cent. of the gross value of the

ore. The dividends paid during the year amounted to $749,313.48, equal to 10 per cent. of the company's capital.

The average number of men employed during the first half of the year was 242. This number was considerably reduced in the latter half, so that the average for the whole year was about 210.

The silver produced was obtained from the following sources:—

	Dry tons	Oz. silver	Net value
La Rose	418.176	455,899.36	$222,096 82
Lawson	95.9865	141,608.14	73,177 70
Princess	245.8155	207,299.91	98,489 16
Concentrates	1,271.7685	563,439.79	243,792 31
Total	2,031.7465	1,368,247.20	$637,555 99

Concentration operations are summarized as follows:

Ore milled	54,020.073	dry tons
Silver content of ore	708,663.	ounces
Average assay of ore	13.12	ozs. per ton
Average assay of tailing	2.75	" " "
Concentrate produced	1,271.7685	dry tons
Silver content of concentrate	563,439.79	ounces
Average assay of concentrate	443.	" per ton
Smelter return on concentrate	$243,792.31	
Marketing expense on concentrate	19.68%	of gross value
Cost of concentration	$132,649.32	
Cost per ton ore milled	2.45	
Extraction	79.5 %	
Average tonnage for 313 days	173.	tons per day
Ratio of concentration	42.5	to 1

The above ore was milled at the new plant of the Northern Customs Concentrators, Limited.

The quantity of mill rock supplied by each mine was:

La Rose	33,882	tons
Princess	18,570	"
Lawson	1,568	"
Total	54,020	"

The picking and jigging plants at the mines produced 134,196 oz. of silver in jig concentrate, shipped with the high-grade ore, and 12,088 oz. in slime shipped as low-grade silicious ore.

The net value of these products was $69,148.

The low-grade ore on the dumps is estimated at 44,359 tons, carrying about 14 oz. per ton.

The following development work was done in 1914:—

	Shafts ft.	Drifts ft.	Crosscuts ft.	Raises ft.	Stopes cu. yds.	Trenches ft.
La Rose	170.	1,129.	1,049.	290.	4,676.	11,193
Princess	....	448.	564.	231.5	2,369.	......
Lawson	9.	835.5	1,018.5	400.	1,014.	......
University	....	73.5	621.	....	....	......
Fisher-Eplett	....	38.5	1,084.	....	....	......
Total	179.	2,524.5	4,336.5	921.5	8,059.	11,193

The most important prospecting done during the first half of the year at the La Rose mine was the exploration of the conglomerate west of the fault on the 380-foot level. The west cross-cut was driven to the boundary, a total distance of 955 feet from the fault; a north and south cross-cut, parallel to the fault, was also driven a distance of 640 feet. This work was not successful in cutting any pay veins. It was then decided to sink a new shaft on the La Rose Extension. This shaft is situated west of the railway, and will explore an area which is largely covered by deep swamp, comprising more than half of the La Rose Extension claim, and lying on the down throw side of the Cobalt Lake fault. The conglomerate has here a depth of about 400 feet. This shaft was started October 12th, and will be sunk to the Keewatin, and cross-cutting started 50 feet above the contact.

Considerable surface prospecting was done on the hill on the eastern side of the La Rose claim where the surface of the rock was exposed by a series of wide trenches. Several small branches of known veins were uncovered.

The Princess mine was closed down November 1st, the ore remaining in No. 12 and No. 3 veins, with the exception of some small pillars, having been removed during the year. This small property of seventeen acres has produced in high-grade ore alone, 2,654,218 ounces of silver, with a net value of $1,409,182.

The Lawson mine was operated during the year at a small profit. The development on the main vein, and the No. 5 vein on the 400-foot level did not lead to any good results. In the southern part of the claim the Keewatin is overlain by diabase, and this ground is being explored by a cross-cut under the contact. A cross-cut from the Lawson mine was run into the University property to cut the vein opened up in the old workings, and a drift on the vein connected with the old shaft near the bottom. The work on the Fisher-Eplett property in southeast Coleman, did not develop any pay ore. The property was closed down in November and the plant removed.

Lumsden

The Lumsden Mining Company, Limited, operated their property at Brady lake, in southeast Coleman, with a force of 17 men working day shift only, during the first seven months of the year.

John Lumsden, Ottawa, is president of the company; Mr. Freeman I. Daniels is superintendent.

The following table shows the progress during the year and to date:—

Level	Drifting	Cross-cutting	Winzes	Raises	Stopes	Shafts	Total
	ft.	ft.	ft.	ft.	ft.	ft.	ft.
225 feet	88	49	....	....	42	....	179
250 "	192	160	....	....	....	....	352
300 "	54	....	....	18	31	....	103
400 "	69	....	....	23	....	....	92
Total 1914...	403	209	....	41	73	....	726
Previous Total........	1,343	746	29	255	....	685	3,058
Total to date.	1,746	955	29	296	73	685	3,784

McKinley-Darragh-Savage

The McKinley-Darragh-Savage Mines of Cobalt, Limited, own and operate the McKinley-Darragh mine at the southern end of Cobalt lake, and the Savage mine on the east side of Cart lake. The board of directors consists of: Mr. C. A. Masten, president; Mr. Thomas W. Finucane, vice-president; Mr. J. R. L. Starr, secretary; Mr. Harper Sibley, treasurer; Mr. Joseph S. Hunn, assistant treasurer; Mr. Hiram W. Sibley and Mr. W. L. Thompson. Mr. T. R. Finucane is manager.

During the year 1914 several small veins were developed on the McKinley property, of which the principal one was No. 54, located near the lake vein. These small veins, together with branches of the main ore bodies, have yielded considerable mill rock.

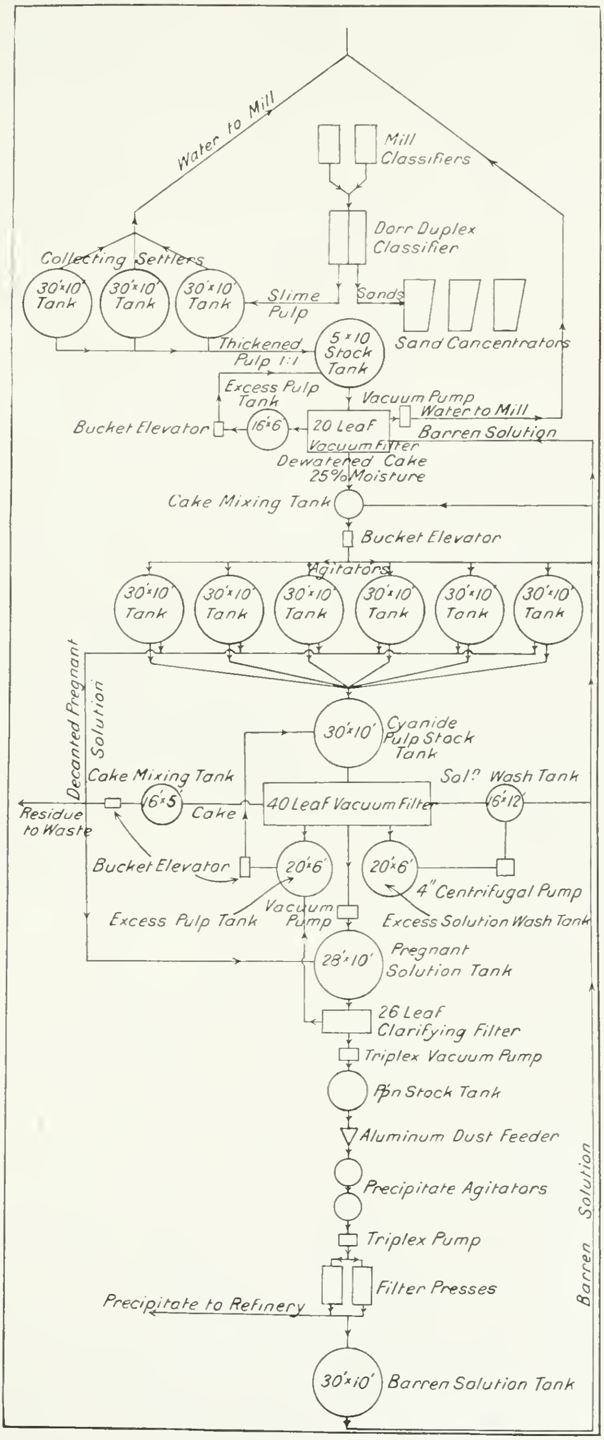
The following is a statement of the underground work done during 1914 at McKinley mine:—

Levels	Drifts	Cross-cuts	Raises	Winzes	Stopes
75 feet	58.5	118	10	nil.	nil.
110 "	43	108.5	11	nil.	2,700 tons
135 "	nil.	nil.	nil.	nil.	nil.
150 "	466	1,363.5	156.5	nil.	17,236 "
200 "	435.5	498.5	219	nil.	14,123 "
250 "	163.5	557	154	31	2,097 "
Total	1166.5	2,645.5	550.5	31	36,156 "

The chief development at the Savage mine during the year was the discovery of vein No. 23, which was located late in the year on the 140-foot level in the southeast quarter of the property. A winze was sunk on the ore to a depth of 55 feet.

The underground work at Savage mine done during the year was the following:—

Levels	Drifts	Cross-cuts	Raises	Winzes	Stopes
85 feet	nil.	nil.	13.5	nil.	76 tons
140 "	542.5	1,372	249.5	139.5	3,562 "
165 "	14	nil.	nil.	nil.	nil.
190 "	125	366	nil.	nil.	61
210 "	nil.	nil.	10	nil.	nil.
245 "	nil.	nil.	14.5	nil.	nil.
Total	681.5	1,738	287.5	139.5	3,699 tons



Flow Sheet of Cyanide Annex Cobalt Reduction Co.

The result of the milling operations of the year is as follows:

—	Tons treated	Number of stamp days run	Average tons per day	Mill heads	Mill tails	Percentage of extraction	Ounces of silver recovered
McKinley ore.........	45,098	320.58	140.68	24.10	3.5427	85.14%	926,295
Savage ore...........	21,656	307.04	70.53	13.37	4.8486	64.13%	186,681
Totals...........	66,754	....	211.21	....	....	....	1,112,976

Including metallics and high-grade ore the silver recovered during the year was as follows: McKinley, 1,159,154 ounces; Savage, 237,386 ounces; total, 1,396,540 ounces, bringing the total production from the opening of the mines up to January 1st, 1915, to 14,380,752 ounces.

The number of men employed at the McKinley has been 100 to 110, and at the Savage 25 to 27.

Mill of Cobalt Reduction Company showing Cyanide addition

Meteor

The Meteor Silver Mining Company, Limited, operated their property on the northwest corner of Diabase mountain with a force of about 15 men.

Mr. David Crawford is president of the company; Mr. D. D. Flanagan is vice-president and general manager.

The development work done during the year consists of 310 feet of drifting, 600 feet of cross-cutting, 73 feet of raising, 102 feet of sinking in the winze, and the cutting of stations at the collar and at the 140-foot level of the winze.

The Mining Corporation of Canada, Limited

The board of directors of the corporation is composed as follows:—President, Sir Henry M. Pellatt, C.V.O.; first vice-president, J. P. Watson; second vice-president, W. R. P. Parker; G. M. Clark, Capt. R. E. G. van Cutsem, D'Arcy Weatherbe, and Graeme Watson.

Capital: 2,075,000 shares, of par value $1 per share, fully issued.

As of the 1st April, 1914, this corporation acquired the mining properties formerly operated by the Cobalt Townsite Mining Company, Limited; Cobalt Lake Mining Company, Limited; The City of Cobalt Mining Company, Limited, and the Townsite Extension Mines, Limited, at Cobalt, which have been placed under the management of Mr. C. E. Watson.

A new two-compartment shaft has been raised from the deepest workings and equipped with steel head-frame, two-ton skips, and a new 12½ by 15-inch double drum hoist. From this shaft the ore is now dumped directly into a bin above the crushers in the mill of The Cobalt Reduction Company, considerably lessening the handling of ore from the Townsite and City mines.

In the last nine months of 1914 the following underground work has been done:—

Townsite mine	7,864½	feet
City mine	2,437	"
Lake mine	2,786	"
Extension mine	1,579	"
Total	14,667	feet

Nugget found on Townsite property during trenching operations

From this work, in the same nine months, 107,384 tons were mined and treated, producing 3,185,124 ounces of silver.

Extensive alterations and additions have been made during the past year in the reduction mill, in connection with which, under the direction of Mr. M. F. Fairlie, the mill manager, a cyanide annex has been erected to treat the slimes from the company's mills.

Nipissing

The Nipissing Mining Company, Limited, with an authorized capital of $250,000, owns and operates 846 acres in the township of Coleman. Mr. David Fasken, Toronto, is president; Mr. R. B. Watson, general manager, and Mr. Hugh Park, manager. The Nipissing Mines Company is a holding company, owning all the stock of the Nipissing Mining Company, and having an authorized capital of 1,200,000 shares of a par value of $5.00 each. The officers and directors of the company are as follows:—Mr. E. P. Earle, New York, president; Mr. R. T. Greene, New York, secretary; Messrs. W. H. Brouse, Duncan Coulson and David Fasken of Toronto; M. A. Viele and August Heckscher of New York; Denis Murphy, Ottawa, and R. B. Watson, Cobalt.

The tenth annual report of the company shows the production for 1914 to have been 4,689,333 ounces of silver, of a gross value of $2,516,064.85, at a cost of 19.8 cents per ounce. The average price received for silver was 56.36 cents per ounce, compared with 60.26 cents the previous year.

The dividends paid during the year amounted to $1,200,000.00.

The ore reserves are the largest in the company's history, and contain about 10,000,000 ounces of silver.

The total number of men employed was 407, distributed as follows: underground, 166; surface, 104; low-grade mill, 70; high-grade mill, 18; hydraulic plant, 41; cookery, 8.

The report gives the production of individual veins as follows:—

——	Silver, oz. in high-grade ore	Silver, oz. in mill rock	Total silver oz.
Shaft 73:			
Veins 73, 80, and 100	1,968,243	1,890,298	3,858,541
Vein 96	....	3,616	3,616
Vein 122	176,358	154,342	330,700
Little Silver	274,577	211,514	486,091
H-40 and H-52	9,131	1,254	10,385
	2,428,309	2,261,024	4,689,333

A summary of the underground work in 1914 shows the following:—

Shaft No.	Drifting	Cross-cutting	Raising	Sinking	Total	Stoping
	ft.	ft.	ft.	ft.	ft.	cubic yards.
63	479.5	172.0	14.0	....	665.5	4,578
64	596.5	708.0	31.5	215.5	1,551.5	....
73	3,014.0	2,358.5	1,205.5	273.0	6,851.0	20,418
80	....	....	....	....	....	754
86	532.5	553.5	113.0	....	1,199.0	....
122	....	....	....	....	....	348
150	256.0	1,376.5	195.0	....	1,827.5	....
H-40	....	....	....	53.0	53.0	....
H-52	....	....	....	....	....	253
Total	4,878.5	5,168.5	1,559.0	541.5	12,147.5	26,351

As the vein in shaft 64 continued strong from the conglomerate where it had contained rich ore shoots, into the underlying Keewatin below the 275-foot level, where it carried low silver values throughout, it was considered advisable to explore it at depth, and the main shaft was sunk to the 902-foot level. A cross-cut 272 feet long was necessary in order to reach the vein, which was then drifted on for 454 feet. From this level an inclined winze was sunk to a depth of 163 feet, and 53 feet of drifting was done on the lowest level, which has a vertical depth of 1,003 feet—the deepest in the Cobalt camp. This work failed to develop any pay ore; the vein is still strong, but assays from 5 to 20 ounces only in silver.

The hydraulic plant was moved from Cobalt lake to Peterson lake, and most of the ground draining into Peterson and Cart lakes from the west was washed clear of soil. An average depth of 3.43 feet of soil was removed from 95.55 acres, at a cost of $500 per acre. This represents a cost of 9 cents a cubic yard, made up of: labour, 5 cents; power, 3.2 cents; supplies, .8 cents.

Several diamond-drill holes aggregating 1,159 feet were put down on the eastern side of Peterson lake, without locating ore. One hole near the edge of the lake showed 300 feet of diabase, then 38 feet of slate lying on top of the Keewatin

The high-grade mill treated 929 tons of Nipissing ore, having an average value of 2,439 ounces per ton, and 965 tons of custom ore, averaging 2,421 ounces per ton; in addition the refinery treated the precipitate from the low-grade mill. The total shipments of bullion for the year were 6,300,177 fine ounces. Bullion and cobalt residues were the only products shipped during the year. Total shipments of residues, all in the first part of the year, amounted to 1,060 tons, which gave a net return of $42,344.06. Experiments are now being conducted with the Cottrell process on the fumes from the furnaces, the object being a possible further saving of silver and mercury.

Operations by the low-grade mill during the year are thus summarized:—

	Dry Tons.	Assay Oz.	Silver Oz.
Ore treated	79,009	30.82	2,435,345
By-products treated	116	.....	87,081
Total milled	79,125		2,522,426
Bullion recovered from the above................			2,261,024
Actual extraction by clean-up			89.64 per cent.

The low-grade ore averaged 3.6 ounces per ton higher than in the previous year, and the mill treated 1,885 tons more.

Research work on the low grade mill operations proved that practically all the rock in the final tube mill discharge will pass a 200-mesh screen, but that the metallics in the ore are flattened out and remain on the screen. Two Callow screens were therefore installed in the tube mill circuits, and these are now recovering from 20 per cent. to 25 per cent. of the total silver in the ore. The dirty metallics from the screens are cleaned on a Wilfley table and the product is melted into bullion. It is expected that this preliminary treatment will lower the cost in the cyanide plant and increase the extraction.

O'Brien Mine

This mine was in continuous operation during 1914, and the production of silver was maintained at a parity with that of the preceding year. The following table shows the development in the several shafts during the year:—

Shaft.	No. 1	No. 2	No. 6	No. 16	No. 20	Main	Total
Drifting ft........	33.5	189	161.7	555.3	835.7	109.5	1,884.7
Cross-cutting ft ...	....	21.8	37	....	22.5	287.6	368.9
Raising ft........	....	100	....	37.5	....	....	137.5
Sinking ft....	....	....	....	....	124	....	124
Stoping tons	3.375	4.843	4.602	18.826	1.410	2.405	35.461

The greater part of this work was done in the diabase area around No. 6 shaft, but a considerable portion of the tonnage came from the lower levels of the same workings, which are in Keewatin.

During the year the winze from the 300-foot level of No. 6 shaft was sunk to a depth of 200 feet, cutting the diabase-Keewatin contact at 180 feet, or 480 feet from the collar of the shaft. In this winze three levels have been opened, some new ore put in sight, and ore proved to exist below the lowest level.

The capacity of the mill was further increased during the year, and a total of 51,892 tons treated, or an increase of 29 per cent. over the tonnage of 1913. The flow-sheet remains unaltered, but several improvements were introduced which contribute to increase the efficiency of the mill.

Total shipments for the year consisted of fifteen cars of high-grade ore and concentrates, and (468) bars of bullion. The ore and concentrates contained 784,573 ounces of silver, and the bullion contained 452,772 ounces, showing a total of 1,237,345 ounces shipped for the year.

The work of development during the year placed in reserves new ore bodies approximately equalling 900,000 ounces, so that the year's extraction shows a net reduction of 350,000 ounces in the ore reserves of a year ago.

The total working force during the year was maintained at a slightly increased average over that of 1913.

Mr. M. J. O'Brien is owner, and Mr. R. H. James, manager.

Penn-Canadian

The officers of the Penn-Canadian Mines, Limited, are:—Mr. Wm. J. Haines, president; Mr. R. B. Haines, secretary-treasurer; Messrs. Jansen D. Haines, Alfred S. Elliott, E. C. R. Laidlaw and Spencer D. Wright, directors. The general office of the company is at 1011 Chestnut Street, Philadelphia, Pa.

During the year the mill treated 24,510 tons of ore.

The ore shipped amounted to 448 tons, sent out as follows:—To Canadian smelters, 539,215 lbs.; to American smelters, 356,787 lbs.

The following changes were made in the mill: 6 new Wilfley tables and one 75-h.p. motor have been added. The Hardinge pebble mills have been changed to ball mills.

The development for the fiscal year ending April 30th, 1915, is as follows:—

——	First	Fourth	Fifth	Sixth	Sub. below fourth	Sub. below fifth	Total
	ft.	ft.	ft.	ft.	ft.	ft.	ft.
Drifting	6.	756.5	1,682.5	539.0	635.5	154.5	3,774
Cross-cutting	188.	145.5	997.0	151.5	....	14.	1,496
Raising.....	....	82.	248.5	77.	24.5	....	432
Winzes	....	....	10.	....	....	....	10
Totals..	194.	984.	2,938.	767.5	660.	168.5	5,712

The total footage to April 30th, 1915, is 17,457 feet.

An average of 122 men has been employed, 15 of whom are in the mill.

Mr. B. Neilly is general superintendent.

Peterson Lake

The Peterson Lake Silver Cobalt Mining Company, Limited, operated under Peterson lake and leased to two other companies, the Seneca-Superior Silver Mines and the Gould Consolidated Mining Company, portions of the bed of Cart lake. Sir Henry Pellatt is president, and Mr. R. B. Lambe, manager and consulting engineer.

The work done during the year consisted of 1,737 feet of drifting and cross-cutting from shaft No. 1 and 2,967 feet of drifting and cross-cutting and 64 feet of raising from No. 2 shaft. In addition to this some stoping was done on No. 7 vein at No. 2 shaft.

Right of Way

The Right of Way Mines, Limited, operated until September 15th, 1914. The officers of the company are:—E. Seybold, president; A. W. Fraser, vice-president; E. A. Larmonth, secretary-treasurer. The head office is at 17½ Elgin St., Ottawa.

Development during the year amounted to 756 feet, comprised as follows: drifting, 606 feet; raising, 90 feet; cross-cutting, 60 feet. While operating, the Colonial mill was used to treat the mill ore.

R. F. Taylor is manager.

Seneca-Superior

The Seneca-Superior Silver Mines, Limited, operate a lease on Cart lake. The company has an authorized capital of 500,000 shares of a par value of $1,00 each.

The officers of the company are as follows:—Mr. S. Harry Worth, president; Mr. F. W. Zoller, vice-president; Mr. R. F. Segsworth, treasurer; Mr. W. E. Segsworth, managing director; Mr. R. H. Lyman, manager.

The property produced during the past year 1,430,674 ounces of silver at a profit of 22½ cents per ounce, after paying to the Peterson Lake Mining Company a royalty of 25 per cent., or 13 cents per ounce. The dividends paid during the year amounted to $335,218.80.

The development during 1914 was as follows:—

	1914.	Three years' total.
Drifting on vein	779.4 ft.	1,770.8 ft.
Drifting on exploration	2,513.5 ft.	6,703.4 ft.
Sinking and raising	152.5 ft.	624 ft.
Total	3,445.4 ft.	9,098.2 ft.

During the year No. 2 plant on the east side of the lake was completed. The equipment comprises a new head frame, shaft-house, 10-inch by 12-inch Rand hoist, 1,040-cubic ft. Rand compressor driven by a 200-h.p. motor, all suitably housed.

Electricity has been substituted for air at both hoists, and a 130-gal. electric pump installed under ground. A machine shop equipped with lathe, drill press and grinder, all electrically driven, has been added to the plant.

The ore-dressing plant has been developed into a small but complete mill. The single jig was replaced by a double jig with tromell and weighing bins. A second Deister sand table and Deister slime table, together with a 4-inch by 8-inch Sturtevant crusher, and a 4½-foot Hardinge ball mill were installed. A complete concentration of all fines from the picking table is now made, and a final mill tail, running about 5 ounces, is now obtained. The shipping product consists of high-grade, jig and table concentrates, all of which go to the Deloro smelter.

From the 16,871 tons of ore hoisted the following product was obtained:—

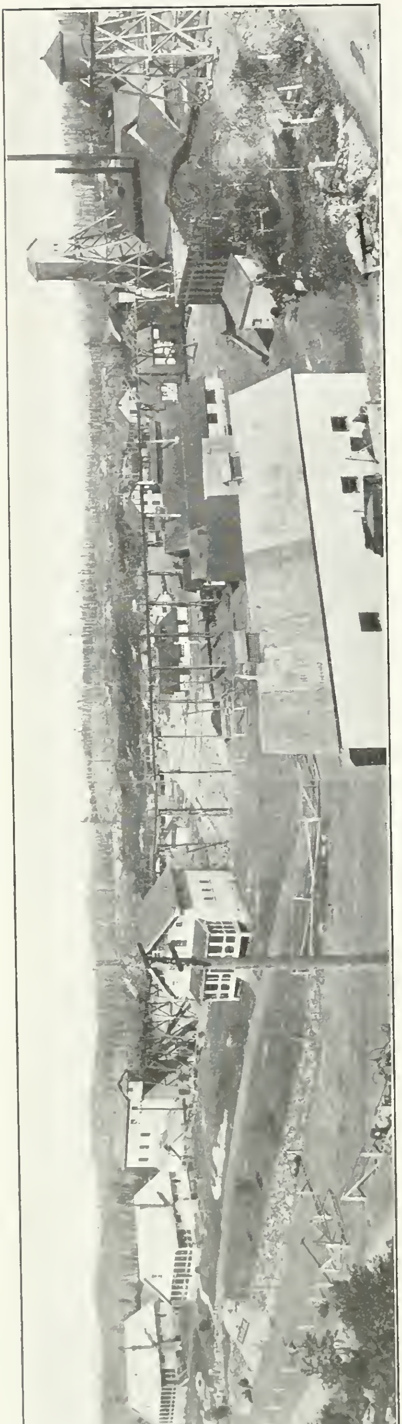
High-grade ore		416.21 tons
Fines for concentrating 2,526 tons, which produced—		
Jig concentrates	40.96 tons	
Table concentrates	67.42 tons	
Total		108.38 tons
Total production		524.59 tons

Number of men employed, 85: underground, 49; surface, 19, and mill, 17.

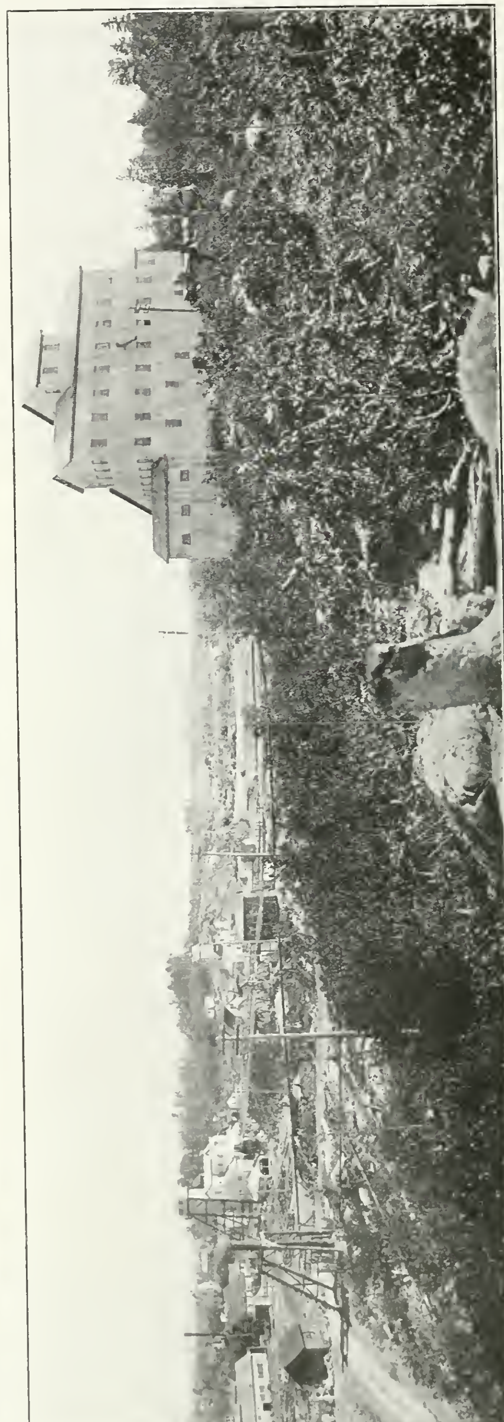
Temiskaming

This property, consisting of the south half of the northeast quarter and the west half of the southwest quarter of the north half of lot 1, in the third concession of Coleman, is owned by the Temiskaming Mining Company, which has an authorized capital of 2,500,000 shares of a par value of $1.00.

The officers of the company are:—Frank L. Culver, president and general manager; Wm. Thos. Mason, vice-president; H. E. Tremaine, treasurer; R. Graham, secretary.



General surface view of Beaver mine

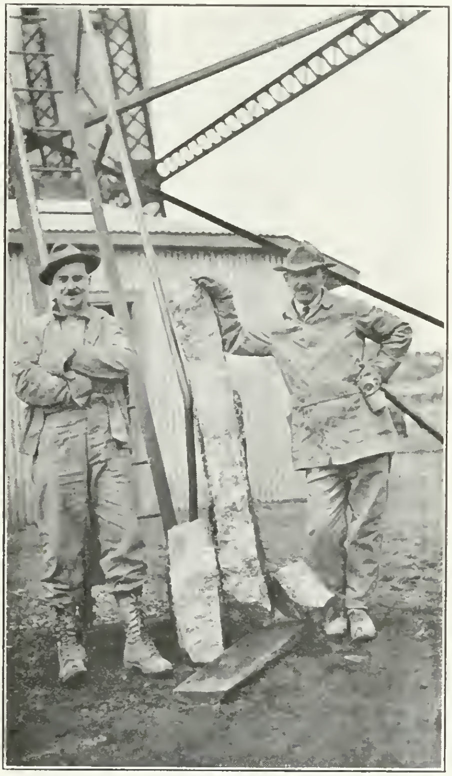


General surface view of Temiskaming mine

Following is the record of development and stoping for the year:—

Drifting	1433.	feet
Cross-cutting	817.	"
Sinking: Winze, 118.5 feet / Shaft, 93.4 feet	211.9	"
Raising	329.5	"
Total	2791.4	"
Stoping	9718.8	cubic yards

Station cut at the 750-foot level.



Section of high-grade vein, Temiskaming mine

On the 750-foot level a small vein was encountered on which drifting was begun; about 40 feet from the shaft a little high-grade ore was encountered. This developed into a shoot of high-grade ore extending some distance above the level and to a depth of 35 feet in a winze sunk 90 feet from the shaft.

Arrangements were made in December with the Beaver Consolidated Mines to drive south into the Temiskaming ground on a rich high-grade vein that had been encountered on the 530-foot level on their property at a point 130 feet west of the Beaver shaft and 55 feet north of the boundary line. The vein had been drifted upon for a distance of 60 feet to Temiskaming ground at the end of the year, and shows from four to five inches of very rich ore. Cross-cuts have been started on the 400- and 500-foot levels to cut this vein, which is in virgin territory about 300 feet west of the old vein system.

Continuing the workings on the 500- and 575-foot levels into the Gans lot, some fine shoots of mill ore and some patches of high-grade ore have been found; this vein is about five inches wide.

The Temiskaming Mining Company operated throughout the year with the exception of the months of August and September.

Trethewey

The Trethewey Silver Cobalt Mining Company, Limited, with an authorized capital of 2,000,000 shares of a par value of $1.00 each, of which 1,000,000 shares have been issued, operated their 40-acre property in the town of Cobalt, and did considerable prospecting elsewhere.

The officers of the company are as follows:—Mr. Alex. M. Hay, president; Mr. S. R. Wickett, vice-president; Mr. L. H. Pashler, secretary-treasurer; Mr. Stuart M. Thorne, manager.

The total production of silver during the year was 527,097 ounces, of a net value of $251,842.67, and a dividend of $50,000 was disbursed.

The total development footage for the year was 2,951.3, at a cost of $11.20 per foot of advance; and the tonnage of ore put in sight per foot of development was 11.3.

A summary of the development by years is as follows:—

Year.	Shafts.	Drifts and Cross-cuts.	Winzes and Raises.	Total Footage for Year.	Total footage to Date.
1906-1907	383	2,099	217	2,699	2,699
1908	...	1,771	360	2,131	4,830
1909	213	2,688	268	3,169	7,999
1910	43	3,010	226	3,279	11,278
1911	102	2,801	168	3,071	14,349
1912	79	2,950	856.5	3,885.5	18,234.5
1913	...	2,194.5	555.5	2,750	20,984.5
1914	...	2,370.4	580.9	2,951.3	23,835.8

The mill treated 35,215.5 tons during the year, at a cost of $1.31 per ton. The average silver contents of the ore was 18.9 ounces, and of the tailings 4 ounces per ton. A recovery of 79 per cent. was made in 604 tons of concentrates, containing 527,097 ounces of silver.

The working force consisted of 95 men, distributed as follows:—Underground, 58; surface, 21, mill, 16.

The option held on the West Beaver mine in the Port Arthur district was allowed to lapse after a considerable expenditure had been made. In April an option was taken on certain locations close to the Casey mine, and 2,081 feet of diamond-drilling was done in an attempt to locate ore. At the end of the year an option was taken on two claims adjoining the Huronia gold mine in Gauthier township, 17 miles east of Dane station. The intention is to prospect these by means of diamond-drilling.

Elk Lake Area

Beacon Consolidated

A contract was let early in the year to Mr. Neil R. Morrison, of Elk lake, to sink the shaft on this property from the 200- to the 500-foot level. Operations were suspended after war broke out, the shaft having then a depth of 370 feet, with stations at the 100-, 200- and 300-foot levels.

The force employed during the sinking operations comprised 16 men.

Mr. Murray D. Kennedy is the company's manager.

Beaver Auxiliary

Operations were resumed on this property in the spring with a force of about 20 men, and continued until August, when the mine was again closed down. When visited early in July sinking operations were being carried on in the shaft at a depth of 275 feet, and two drifts were being driven on the 200-foot level.

The 12 by 15 hoist, replaced at the Beaver mine at Cobalt, is now in use at the Beaver Auxiliary.

Mr. H. L. Donaldson is manager.

Boucher Claims

Some open-cut work was done on these claims, which adjoin the Fleur-de-Lis property.

Landrus=Charland

The shaft on this property, situated in the north half of lot 2, concession 5, James township, has been sunk to a depth of 115 feet.

There were 9 men employed, in charge of Mr. J. L. Landrus. The property closed down on August 15th.

Mapes=Johnston

The Mapes-Johnston claim, near Silver lake in the township of Mickle, continued operations during the year with a force of 12 to 16 men. The property was visited by a forest fire during the summer which destroyed all their camp buildings, including the new camp, 20 by 34 feet, which had just been completed. The power-house and mine buildings were saved.

The power-house, a frame building 34 by 40 feet, was built during the year. The plant consists of 1 60-h.p. locotmotive-type boiler, a 3-drill compressor, and a 6 by 8 hoist.

During the year the shaft was sunk to the second level, a depth of 187 feet, with 9 feet of sump. The drifting on the 100-foot level amounts to 170 feet—90 feet north and 80 feet south—and 20 feet of cross-cutting. The drifting on the second level amounts to 96 feet, and the cross-cutting to 30 feet. A raise has been carried 60 feet from the second level, and a winze 15 feet. The manager, Mr. D. G. Oliver, expects to make a shipment of ore before the close of the winter.

Oliver

Sinking operations were being carried on at this property, situated near Long Point lake, the half-way point between Elk lake and Gowganda. The shaft had a depth of 114 feet when visited on July 2nd. Operations were suspended about the end of that month. There is an old level at 50 feet, with about 90 feet of cross-cuts. The plant consists of a 20-h.p. boiler and a 5 by 6 hoist. Mr. John Wilson is superintendent.

Paragon

The Paragon Silver Mining Company, Limited in Willett township, has been operating during part of the year. The shaft has been continued from a depth of 86 feet to a depth of 120 feet. There are drifts 20 feet each way on the vein on the 90-foot level.

The plant consists of a 50-h.p. boiler of the locomotive type, and a 5 by 7 Napanee hoist. A force of 10 men were employed under superintendent J. P. Welsh. Mr. David Melville, Collingwood, is secretary.

Maple Mountain District

Goldie Lake

The Montreal River Silver Mining Company let a contract during the year for shaft sinking on their property at Goldie lake to George Christie. The shaft was sunk to a depth of 131 feet, and 35 feet of cross-cutting was done.

The plant consists of a 15-h.p. boiler, and a 5 by 5 hoist.

Captain Pearsall of Collingwood is secretary-treasurer of the company.

Rubicon

The Rubicon Silver Mining Company let to Barry Webster and Ernest Moore of Latchford a contract for sinking the shaft on their property in Whitson township from 64 to 100 feet. They employed from four to ten men.

The plant consists of a 15-h.p. boiler and a 5 by 5 Jenckes hoist.

Mr. S. J. Callaghan, 180 St. James St., Montreal, is manager of the company.

White Reserve

The White Reserve Mining Company, Limited, in Whitson township operated during the latter part of the year with a force of 10 men.

The new work consists of an advance of 40 feet in the northwest cross-cut and the sinking of a prospect shaft 66 feet in depth.

The main shaft has a depth of 150 feet with levels at 70 and 140 feet. The work on the first level consists of a cross-cut 70 feet south and 100 feet of drifting. The work on the 140-foot level consists of cross-cuts 50 feet south and 260 feet northwest.

The plant consists of a 120-h.p. return tubular boiler, a 9-drill Rand duplex air compressor and a 10 by 12 Ingersoll-Sargeant link-motion hoist.

Mr. J. A. McAndrew, Toronto, is owner, and Mr. Alexander Coburn, manager.

Gowganda Area

Hewitt

The Hewitt Lake Mining Syndicate operated during the year with a force of 23 men on their property in Nicol township. The shaft was sunk from a depth of 155 to 312 feet, and levels opened at a depth of 200 feet and 300 feet. During the year 800 feet of drifting and cross-cutting was done on the 200-foot level, which developed some ore. Drifting was in progress on the 300-foot level at the time of last inspection in February, 1915.

A 60-h.p. boiler has been installed, replacing the two small boilers formerly in use. This is used to drive a 3-drill compressor and an 8 by 10 Jenckes hoist.

Mr. M. F. Cottrell is manager.

Mann Mines

The Mann mines were operating during the first eight months in the year, having a force of 37 men in July. No. 3 shaft had been completed to a depth of 205 feet and the new shaft, or No. 5, had reached a depth of 70 feet. The mine closed down in the latter part of the year.

Mr. G. R. Rogers was manager.

Miller-Lake O'Brien

Most of the underground work on this property was carried on from No. 2 shaft, from which during the year an additional level was opened at a depth of 450 feet. Operations were carried on mainly on the 300-, 350- and 400-foot levels. The stoping amounted to about 14,000 cubic yards.

A new shaft, No. 20, was sunk to a depth of 60 feet on the hill south of the old mine. Drifts were driven on the vein at this point 50 feet east and 65 feet north and south.

No. 10 shaft on the Millerett property was continued from 25 feet to a depth of 128 feet. At the 60-foot level the vein was driven on 80 feet to the north and 90 feet to the south. Short cross-cuts were also driven 25 feet east and 15 feet west. A level was begun at the bottom of the shaft.

A summary of the development for the year is as follows:—

Shafts and winzes	253 ft.
Raises	176 ft.
Drifts and cross-cuts	2,123 ft.
Total	2,552 ft.
Surface prospecting	3,030 ft.

The mill ran for about three months during the year, and treated 2,348 tons, producing 46 tons of concentrates.

A compressor-house was built at the mine for the new 20-drill Rand air compressor and 350-h.p. motor with which it is driven. Also a transformer-house for the necessary equipment.

Half a mile of track was constructed to connect the mine and the mill, and a gasoline locomotive installed for haulage.

Two electric motors of 40-h.p. and 60-h.p. were installed in the mill.

Shaft-houses were built at No. 10 and No. 20.

Due to lack of water following the exceptionally dry season the amount of power derived from the hydro-electric installation fell much below expectations. The lack of power, together with the outbreak of war, caused a reduction in the number of employees from 150 in the early part of the year to about 50 in the last quarter. During the summer the dam at Hanging-stone lake was raised and improvements were made for storage as far up as Smoothwater lake on the east branch of the Montreal river, to guard against a shortage of water in the future.

The power-house at the outlet of Gowganda lake contains two turbines, a 900-h.p. generator, with exciter and switchboard equipment complete. The wheel pit is connected with the dam by 1,500 feet of 7-foot flume and the head of water is 27 feet.

Mr. K. D. Woodworth is manager of the property.

South Lorrain

Currie

The Pittsburg Lorrain Syndicate operated this property adjoining the Wettlaufer mine during the year, with a force of from 15 to 25 men. The workings consist of a shaft of which the first 200 feet is an incline of about 45 degrees, and the next 200 feet is vertical, about 330 feet of raises and winzes and 1,650 feet of drifts and cross-cuts. This represents the work done up to November 1st, 1914, in the two years the property has been working.

The plant consists of a motor-driven air compressor, capacity 440 cubic feet; one 6 by 8 hoist, and two 5 by 5 hoists.

Mr. J. A. Rice is manager.

Keeley

The Huronian Belt Syndicate operated the Keeley mine during part of the year. The force was cut down from 85 to 20 in August, and in September to six men, who were sinking by hand in No. 2 shaft. The mine was closed about October 15th.

No. 1 shaft has a depth of 205 feet, with considerable development on two levels. No. 3 shaft has a depth of 265 feet, and from the bottom level a winze has been sunk to a depth of 80 feet.

Mr. James Harkness is manager.

Maidens

The Maidens Silver Mining Company was operating its property during most of the year with a force of six men. A winze was being put down in November about 200 feet from the shaft and had reached a depth of 60 feet below the 75-foot level. There is another shaft of the same depth—85 feet—which was not working.

The plant consists of a 25-h.p. boiler and two hoists, a 6 by 8 and a 5 by 5.

Mr. Norman Maidens is manager.

Tallen

Mr. J. G. Dodd had a contract for sinking a shaft on the property of the Tallen Mining Company, Limited, half a mile southwest of the Currie, in the latter half of the year. Work was started in a prospect shaft 60 feet deep, from the bottom of which 120 feet of drifting had been done. This shaft had a depth of 180 feet on March 1st, 1915.

The plant consisted in November of a 30-h.p. boiler, and a 5 by 5 hoist. The force comprised 13 men.

Porcupine Gold Area

The gold mines at Porcupine were less affected by the extraordinary conditions which characterized the year 1914 than any other of the mining districts of the Province. Satisfactory progress was made, and an air of optimism was observable throughout the camp.

Acme Gold Mines, Limited

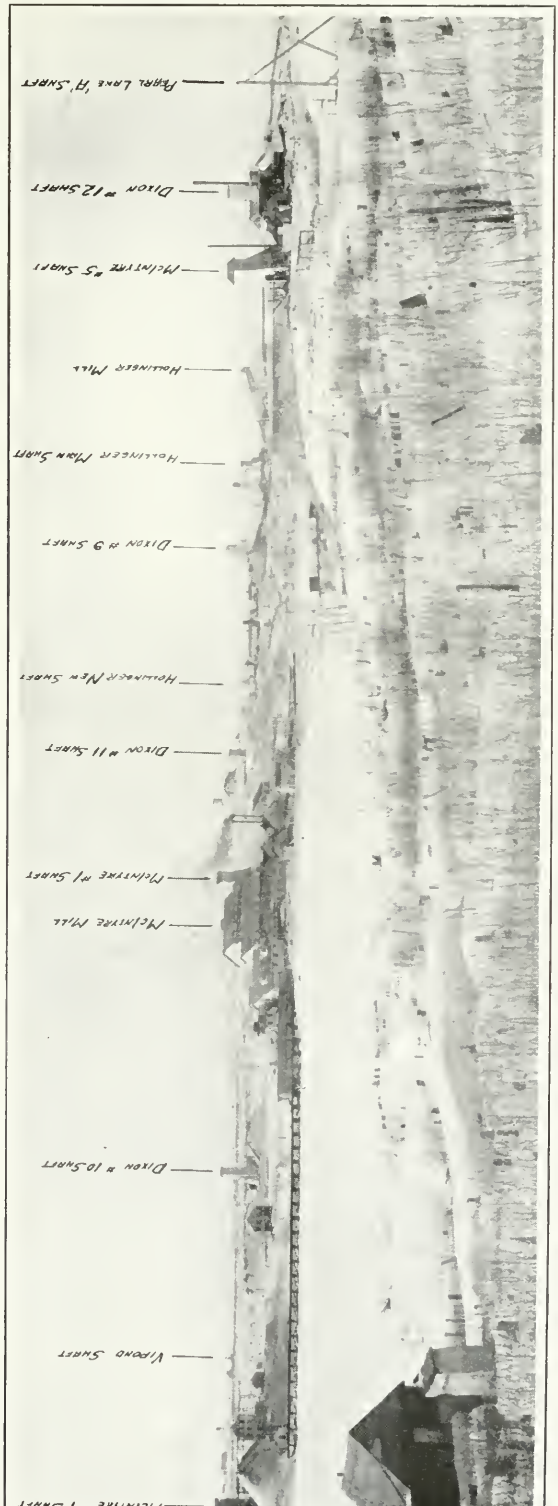
The Acme property comprises four 40-acre claims lying to the east of the Hollinger mine, and is owned and operated by the Canadian Mining and Finance Company, Limited.

The following table gives the development for the year:

——	Shafts	Drifts	Cross-cuts	Excavation at Stations	Raises
No. 9 Shaft—	ft.	ft.	ft.	ft.	ft.
Shaft-sinking	362				
100-foot Level					
200 " "		1,420	826		
300 " "		195	197		
425 " "		615	428	290	
550 " "		8	115	160	
Total	362	2,238	1,566	450	
No. 10 Shaft—					
No. 10 Shaft	210				
200-foot Level		305	69	150	
425 " "		3	170	190	
Total	210	308	239	340	
No. 11 Shaft—					
No. 11 Shaft	303				
200-foot Level		50	53	200	
300 " "		20	26	200	
Total	303	70	79	400	
No. 12 Shaft—					
No. 12 Shaft	124				
100-foot Level		250	260	190	
Total	124	250	260	190	
Work done from Hollinger on Acme ground—					
100-foot Level		110	6		55
200 " "		216	29		
Total		326	35		55
Grand Total	999	3,192	2,179	1,380 tons	55

Surface trenching .... 1,300 feet

An addition of 40 stamps to the Hollinger mill is treating Acme ore.



Panoramic view, looking south across Pearl lake, of several Porcupine mines

Canadian Mining and Finance Company, Limited

The Canadian Mining and Finance Company, Limited, owns and operates the Acme and Millerton claims immediately adjoining those of the Hollinger Gold Mines, and also acts as general manager for the latter company. The Millerton property comprises three 40-acre claims lying to the southwest of the Hollinger. The directors of the company have also acquired the townsite of Timmins, adjoining the Millerton property on the northwest.

The officers of the company are as follows: L. H. Timmins, president; J. McMartin, vice-president; D. A. Dunlap, treasurer; J. B. Holden, secretary, and P. A. Robbins, general manager.

In order to secure the maximum economy in operation of all the properties controlled by the company, the Canadian Mining and Finance Company has during the year constructed a central air-compressing and water-pumping plant, which will be sufficient for the combined requirements of the several properties for some years to come.

This central air-compressing plant has been located in a fireproof building of reinforced concrete and steel on the shore of Gillies lake, and adjoining the railway. Three compressors, having a capacity of 4,500 cubic feet of free air per minute each, have been installed, with space for additional units. One compressor, a Fraser & Chalmers machine, is of special design, being constructed with valves which automatically adjust the output of the machine to the exact requirements of the demand for air, thus doing away with peak loads and thereby reducing the cost of power, which is purchased upon a basis of peak loads. The other two compressors, supplied by Nordberg, are also of special design, for, not only are they a particularly efficient type of machine, but they possess the unique advantage of being reversible; that is, they may be operated as steam engines and their motors may be used for generating electric power. They are standard two-stage cross-compound machines, having cylinders 22 by 37 by 31 inches, with mechanically operated Corliss valves. Each compressor is driven by a 25-cycle synchronous motor at 105 r.p.m. Steam may be turned into the high-pressure clinder of the compressor, being delivered to the intermediate receiver and thence to the low-pressure cylinder, as in any Corliss engine. The operation will, of course, be reversed, and the motor turning in the opposite direction will act as a generator. With a slight readjustment of the valves the machines will be nearly as efficient as engines designed for the work. By this arrangement enough current can be generated to run the mine at reduced capacity, until service from the usual source is resumed.

A boiler plant, consisting of four Wick boilers, 350-h.p. each, sufficient to meet these emergency requirements, has also been installed in connection with the power plant. Incorporated with the air-compressing plant is a pumping plant for supplying water to the Hollinger mill, and to emergency fire-pumps.

The Canadian Mining & Finance Company is also sinking a central shaft which will serve all three properties, and which will be equipped with a central coarse crushing plant. This shaft, situated on the Acme property, close to the Hollinger line, will have six compartments, with stations at 425 feet, 800 feet, 1,250 feet, and it is hoped at deeper levels. From each station cross-cuts will be driven to tap the various ore bodies on the different properties. Electric locomotives operating in the cross-cuts will collect the ore from each property and deliver it at the central shaft. The ore will pass through preliminary crushers, and will then be hoisted to the surface and be delivered to secondary crushers, which will reduce it to a size suitable for stamping in the Hollinger mill. Two compartments will be utilized for hoisting ore, two for handling men and supplies, one for carrying on development at lower levels, and one for ladderway, pipes and electric conductors. While the levels at the central shaft will be at intervals of 450 feet, it is proposed to develop the various ore bodies by means of sub-levels spaced at shorter intervals. The first two compartments of the central shaft had, at the end of the year, been put down over 200 feet, and it is expected to have this shaft in operation by the middle of 1916.

Dome Mines

The property operated by the Dome Mines Company, Limited, is situated on the north half of lot 4 in the first concession of Tisdale township. The company has an authorized capitalization of 500,000 shares, with a par value of $10 each.

The officers of the company are: J. R. De Lamar, president and treasurer; W. S. Edwards, first vice-president; C. D. Kaeding, second vice-president and general manager; H. P. DePencier, third vice-president; Alex. Fasken, secretary; Alfred H. Curtis, assistant secretary and assistant treasurer.

During the year a total of 265,597 tons was mined and hoisted. Of this 248,550 tons was ore which went to the mill, and 17,047 tons was waste which went to surface dumps. All of the 248,550 tons of ore was milled, resulting in a net yield of $1,055,496.78, the average being $4.25 per ton.

The total operating cost per ton milled for the year, including all development and diamond-drilling, but excluding depreciation, was $2.967, which compares with $4.197 for the preceding year, the decrease being $1.230 per ton.

The development work was distributed on the various levels and within a zone 1,500 feet long by 400 feet wide. Besides definitely determining the two million tons "indicated" by incomplete development a year ago in the vicinity of No. 2 shaft there has been developed, in addition, a large body of better grade ore on the fourth and fifth levels, of a character similar to that originally milled from the so-called "dome."

Ore reserves at 1st April, 1915, were estimated at 2,782,811 tons of an average value of $4.15 per ton, or a total of $11,576,859.

Details of the development work done during the year are as follows:

Level	Drifts	Cross-cuts	Raises	Box-holes	Shaft	Total	Diamond Drilling	Total
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
1st	98	632	268	360	....	1,358	....	1.358
3rd	700	811	330	....	....	1,841	900	2.741
4th	297	389	208	....	....	894	....	894
5th	581	372	311	172	....	1,436	1,622.5	3.058.5
6th	295	207	109	....	....	611	1.192	1.803
Shaft	....	....	....	....	83	83	....	83
Surface	....	....	....	....	....	....	2.160.6	2.160.6
Total	1,971	2,411	1,226	532	83	6,223	5,875.1	12.098.1

Enlarging and straightening drives, station construction, sumps, 85,000 cubic feet.

The addition to the milling plant was completed and put into operation in June, although the merging of the new and old units was not completed until August. It was expected by the management that a duty of 28,000 tons per month would be reached and perhaps exceeded in 1915.

During the past year the plant operated a total of 342 days, or 93.7 per cent. of the total possible time. The following table gives the ore value, bullion and recoveries:

—	—	Per ton	Per cent. —	Per cent. Extraction
	tons	$ c.	$ c.	
Value of ore sent to mill	248,550	4 68	1,163,954 80	90.6
Bullion by amalgamation	$671,054 44	2 70	57.6 per cent.	....
" by cyanidation	384,442 34	1 54	33.0 "	....
Total bullion	$1,055,496 78	4 24+	....	90.6

An increase in the amalgamating plate area is in process of erection, as a greater extraction by amalgamation is expected. The operating cost of $0.99 per ton compares with the previous year's figure of $1.440, amounting to a saving of $0.45 per ton milled.

The physical condition of the property is improved. There are now larger and better air and steam mains, improved heating, better houses and offices, roads, etc. The small 16-cubic feet ore cars used for tramming and hauling ore on the main level and up the incline shaft to the crusher house have been replaced by 93-cubic feet cars. This work entailed the enlarging and straightening of drifts, relaying several thousand feet of track with improved equipment, constructing a head frame, bins and grizzlies. The cost of crushing and conveying during the year has been reduced from $0.252 per ton to $0.126.

To facilitate the handling of the ore a system is being installed consisting of 5-ton cars for use underground, an underground crusher, automatic loading hoppers, 4-ton skips, and a surface haulage with 5-ton cars to the crusher house from No. 2 shaft. The skips have been installed and are operating, and the loading station and ore pocket below the fifth level completed. The crusher station and ore passes are 50 per cent. complete. It is expected that this system will be in operation by the summer.

A system of shrinkage stopes has been laid out underground on the third and fifth levels and breast stopes cut, with box holes and chutes completed, so that a large stoping area will soon be available for underground mining.

Dome Lake

The Dome Lake Mining and Milling Company did a large amount of development work during 1914. The plant was electrified, but so arranged that steam from the boiler plant is still available in case of a failure of power. A new 150-h.p. motor was installed in the compressor-house and smaller ones in the mill. A skip has been put in, in balance with the cage, for hoisting ore and waste. The rock crusher was moved from the upper floor of the mill to a position beside the shaft, where the ore is fed from a sorting table, and discharges into a belt conveyor which delivers it to the mill. An addition was built to the east side of the mill to contain extra concentrating tables.

The main shaft was sunk an additional 210 feet to a depth of 445 feet, and levels opened up at depths of 300 and 400 feet from the surface. An ore pocket was put in below the 400-foot level.

The mill was in operation about two-thirds time during the last two months of the year, treating some 1,600 tons of $9 ore, but was ready for steady operation at the end of the year.

The underground work during the year was as follows: Shaft-sinking, 210 feet; drifting, 1,478 feet; cross-cutting, 1,465 feet; raising, 95 feet.

Mr. A. H. Brown is manager and Mr. Geo. C. Cochrane superintendent, employing about 60 men.

Foley-O'Brien

The Foley-O'Brien Mines, Limited, operated until August 20th with a force of about 20 men. The development for 1914 was as follows:

In No. 2 shaft an incline winze was sunk 100 feet from the 160-foot level to the 250-foot level; 600 feet of drifting and 200 feet of cross-cutting were done on the 250-foot level.

No. 3 shaft was deepened from 90 feet to 235 feet, and 100 feet of cross-cutting was done on the 230-foot level.

The officers of the company were: Mr. C. L. Sherrill, president, and Mr. H. B. Hatch, manager.

Hollinger

The holdings of the Hollinger Gold Mines, Limited, consist of four 40-acre claims. The company has an authorized capital of $3,000,000. divided into six thousand shares of a par value of $5.00. The officers of the company are as follows: Noah A Timmins, Montreal, president; John McMartin, Cornwall, vice-president; David A. Dunlap, Toronto; secretary-treasurer; general managers—Canadian Mining & Finance Co., Ltd.; P. A. Robbins, general manager.

The fourth annual report of the company shows $2,688,354.80 of gold won as the result of milling, 208,936 tons of ore of an average value of $13.67; gross profits amounting to $1,786,679.66, or almost exactly two-thirds of the total gold recovered; dividends paid amounting to $1,170,000; and ore reserves increased by $2,087,000. Operating costs have been reduced, and now amount to $4.42 per ton, exclusive of depreciation charges. Of this amount mining costs total $2.70 per ton of ore milled, and milling costs amount to $1.22.

During the past year the number of stamps in the mill has been increased to 60, and alterations have been made to the cyanide plant with the net result that the capacity of the mill has been increased to 800 tons per day.

The average number of men employed during the year has been 546, starting with 510 at the beginning of the year, and ending with 725. The distribution was as follows: Mining, 297; Construction, 109; Mill, Office and General, 140.

The year's work in the mine is summarized in the company's annual report as follows:

Development:—

Level	Shafts	Drifts	Cross-Cuts	Raises	Winzes	Diamond Drilling	Timbering
	ft.	ft.	ft.	ft.	ft.	ft.	ft.
Surface	....	....	....	....	....	4,142	36
100 feet	90	672	191	20	....	1,566	1,210
200 feet	....	2,528	637	125	....	2,152	1,178
300 feet	82	1,736	755	163	....	1,161	1,180
425 feet	117	952	871	162	32	989	175
550 feet	19	710	290	27	126	217	106
675 feet	....	....	62	....	129	....	106
800 feet	....	90	26	....	....	....	....
	308	6,688	2,842	497	287	10,227	3,991

Total development, 10,622 feet. Surface trenching amounting to 2,200 feet was accomplished.

Stoping:—

Level	Broken Ore in stopes, Jan. 1, 1914	Ore broken during 1914	Ore removed during 1914	Broken ore in stopes, Dec. 31, 1914
	Tons	Tons	Tons	Tons
100 feet	4,990	54,870	40,960	18,900
200 feet	8,570	106,652	78,722	36,500
300 feet	....	54,298	42,898	11,400
425 feet	....	1,791	1,791	....
	13,560	217,611	164,371	66,800

Hoisting:—

The ore hoisted from the mine was drawn from the following sources:—

Level	No. 1 Vein	No. 2 Vein	No. 3 Vein	No. 4 Vein	No. 5 Vein	No. 8 Vein	No. 10 Vein	No. 16 Vein	No. 37 Vein	No. 38 Vein	No. 41 Vein	Total
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Above 100 ft.	3,617	22,004	54	5,299	8,027	3,873	.....	.....	17	2,791	.....	45,682
Above 200 ft.	29,430	13,997	20	30,629	13,218	167	622	538	418	.....	3,681	92,720
Above 300 ft.	32,355	3,853	.....	9,991	607	3,850	.....	.....	.....	.....	3,241	53,897
Above 425 ft.	7,699	1,844	.....	1,681	.....	.....	.....	.....	.....	.....	.....	11,224
Above 550 ft.	5,240	.....	.....	83	.....	.....	.....	.....	.....	.....	.....	5,323
Above 675 ft.	404	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	404
Above 800 ft.	749	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	749
	79,494	41,698	74	47,683	21,852	7,890	622	538	435	2,791	6,922	209,999
Acme Gold Mines Limited												2,910
Total												212,909

A summary of the ore reserves taken from the company's report shows the following:—

——	Tons	Value per ton	Estimated gross value Dec. 31st, 1914	Estimated at Dec. 31st, 1913
		$ c.	$	$
No. 1 Vein	333,850	14 85	4,958,210	5,559,900
No. 2 Vein (North)	165,720	10 71	1,775,740	2,129,500
No. 2 Vein (South)	111,150	7 96	885,690	....
No. 3 Vein	22,600	7 47	169,000	169,000
No. 4 Vein	163,330	11 37	1,857,670	1,398,800
No. 5 Vein	50,900	12 53	637,760	406,500
No. 7 Vein	17,000	10 51	178,000	265,000
No. 8 Vein	45,910	8 52	390,740	326,000
No. 10 Vein	9,000	12 00	108,000	....
No. 16 Vein	56,200	8 65	486,130	....
No. 37 Vein	32,800	12 22	400,900	400,900
No. 38 Vein	5,800	16 17	93,800	124,000
No. 41 Vein	90,700	8 34	756,780	33,200
No. 44 Vein	8,000	20 00	160,000	192,000
Miscellaneous	50,000	10 00	500,000	600,000
	1,162,960	$11 49	$13,358,420	$11,271,400

The above estimate of reserves shows an increase of 317,660 tons of ore, and an increase from $11,604,800 to $13,358,420 in gold contents, as compared with the estimates made at the end of 1913.

During the year 208,936 tons were milled, containing $2,857,397.54, which figures, taken with the increase in estimated reserves, show 526,596 tons, containing $4,611,017.54, to have been developed during the year.

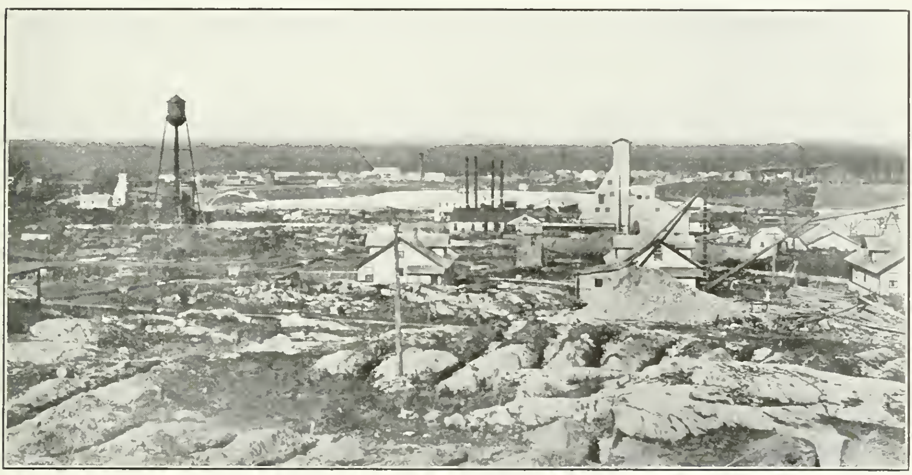
The average value of the ore now shown is $11.49 per ton, as compared with $13.71 per ton at the end of 1913, this falling off in grade being primarily due to the development of considerable tonnages of lower grade ores, thus lowering the over-all average value.

Considerable increases are shown in several of the veins by the development carried out during the year, the principal increases being:—

No. 2 Vein	$531,930 increase
No. 4 Vein	458,870 increase
No. 5 Vein	231,260 increase
No. 16 Vein	486,130 increase
No. 41 Vein	723,580 increase

Hollinger Reserve

The Hollinger Reserve Mining Company's property was worked under option during the first two months of 1914 by interests allied to the Kerr Lake Mining Company, who employed a force of 43 men. Mr. H. W. Evans was manager. The option was not exercised, however, and the property remained closed during the rest of the year.



Hollinger shaft and town of Timmins
The hill in the background is on the north boundary of Godfrey township, 11½ miles from the Hollinger mine.

Jupiter

The property of the Jupiter Mines, Limited, was pumped out in April and work started by the McKinley-Darragh-Savage Mines of Cobalt, under option of purchase. Work was continued until December, when the option was allowed to lapse.

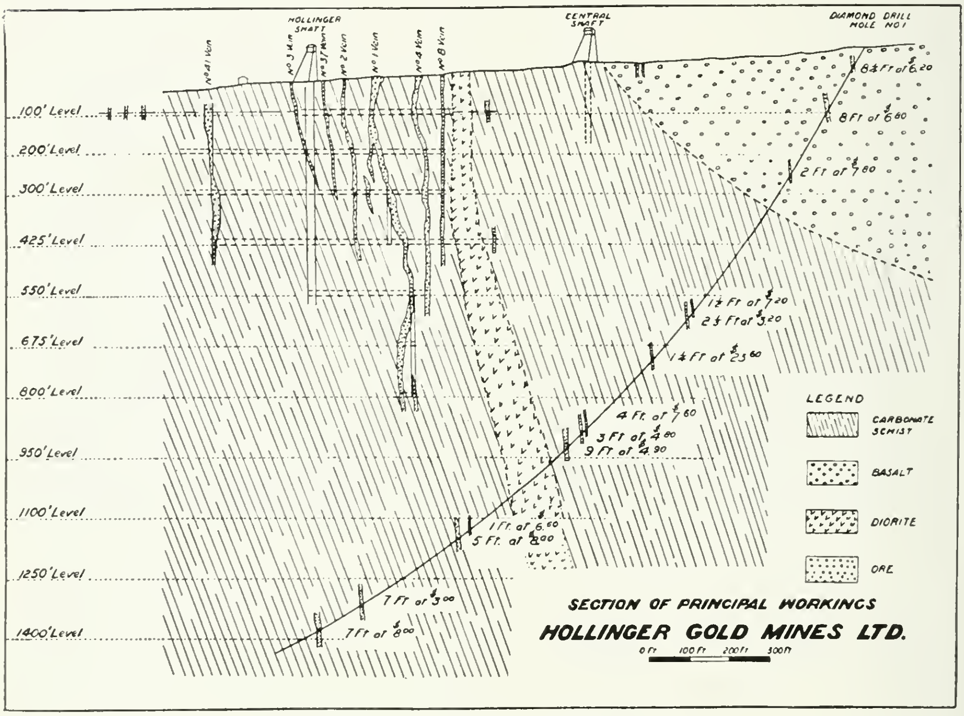
The development during the year included the following: The winze in No. 2 mine, which was down 100 feet below the 300-foot level, was sunk another 75 feet. A raise was put up 25 feet. About 150 feet of drifting and 600 feet of cross-cutting on the 300-foot level, about 550 feet of drifting and 12 feet of cross-cutting on the 400-foot level, and about 300 feet of drifting and 33 feet of cross-cutting on the 475-foot level were done; also some 3,000 feet of diamond drilling from the surface, and about 2,000 feet from points underground.

McIntyre-Porcupine

The McIntyre-Porcupine Mines, Limited, operated continuously during 1914. The directors and officers of the company are: Mr. Albert Freeman, New York, president; Mr. C. B. Flynn, New York, vice-president; Mr. M. P. van der Voort, Toronto, secretary-treasurer; Mr. J. P. Bickell, Toronto; Mr. H. L. Kramer, Toronto; Mr. I. J. R. Muurling, New York; Mr. R. J. Ennis, general manager.

A summary of the work done during the year is given in the following table:—

Tons of ore broken	70,896
Tons of ore milled	62,209 worth $9.26 per ton
Bullion shipped	$549,583
Bullion produced	$556,000
Footage driven:—	
Shafts	209.00 ft.
Drifts	4,059.55 "
Crosscuts	1,420.60 "
Raises	1,079.80 "
Winzes	146.40 "
Total	6,915.35 "



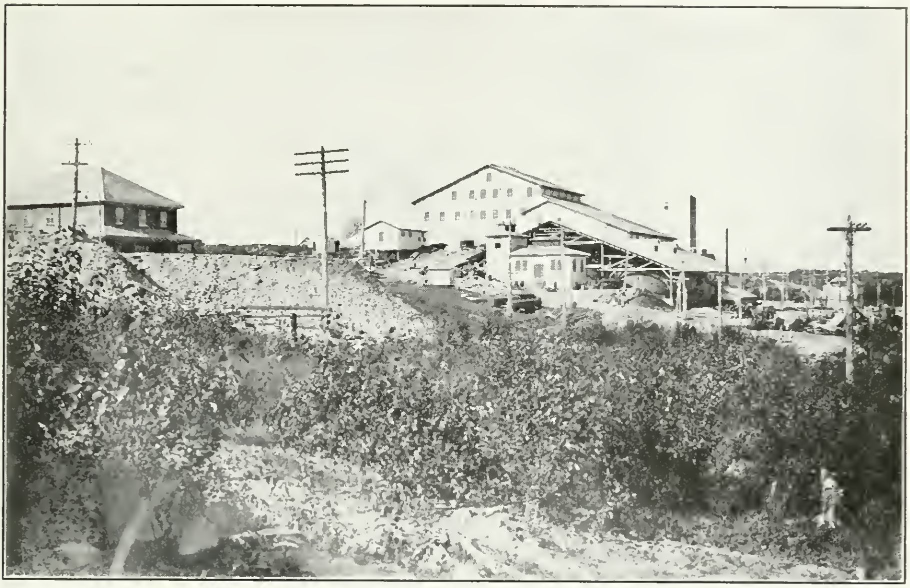
Diamond-drill hole No. 1, Hollinger mine

Diamond drilling	3,294.6 ft.
Average number of men employed:—	
Underground	95
Surface including construction	78

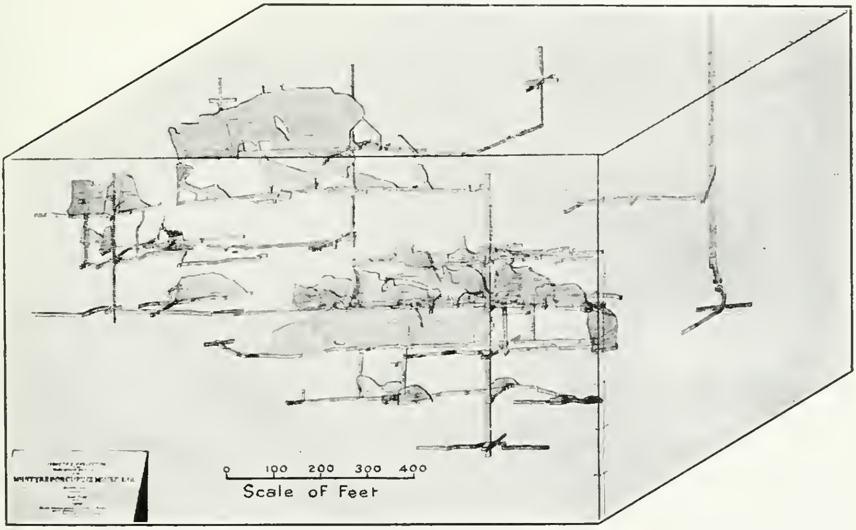
Depth of shafts:—	
No. 1	300 ft.
No. 2	90 "
No. 3	90 "
No. 4	600 "
No. 5	400 "

Construction:

Addition of a 150-ton unit to the cyanide mill.



Mill of McIntyre-Porcupine mines



Isometric projection of the underground workings of the McIntyre mine

Miracle

The Porcupine Miracle Mining Company operated during the year with a force of from 20 to 28 men. Mr. Geo. J. Miller is manager.

The 100-foot shaft was deepened 35 feet to allow for an ore pocket and a sump. About 130 feet of drifting was done on the 100-foot level, and a raise was put up 100 feet to the surface.

A mill with a capacity of 60 tons per day has been built on the property, and is nearly ready for operating. Power is supplied by two boilers of 80-h.p. and 100-h.p. The crushing plant consists of 9 by 15 and 7 by 10 jaw crushers; and the fine grinding plant of a 60-ton Hardinge ball mill, and a 60-ton pebble mill. The mill contains five 10 by 26 Dorr thickeners, and three 10 by 12 Dorr agitators.

North Thompson

The property of the North Thompson Associated Mine, Limited, consists of a 40-acre claim lying between the Porcupine Crown and the Vipond mines, on which an option was secured early in the year by the Huronian Belt Syndicate for the Associated Gold Mines of West Australia.

In order to test the property a large amount of diamond-drilling was done. A shaft was sunk to a depth of 100 feet; and 700 feet of drifting and 360 feet of cross-cutting was done on the 100-foot level, which proved a considerable body of ore.

The following buildings were erected: power-house, office, dry, blacksmith shop, and a residence for the manager. The plant consists of two locomotive-type boilers, 60 and 40 h.p.; one Rand two-stage straight line air compressor of 630 cubic feet capacity, and one 6 by 8 Jenckes hoist.

Mr. N. J. Evered is manager. The force varied from 12 to 36 men.

Pearl Lake

The Pearl Lake Gold Mines, Limited, was working in January with a force of 19 men, but closed down soon after and remained closed the rest of the year.

Mr. Harold Roche is manager.

Porcupine Crown

The Porcupine Crown Mines, Limited, operated throughout the year with a force of from 140 to 150 men.

The officers of the company are as follows: Mr. John W. Carson, president; Mr. W. I. Gear, vice-president; Mr. Jas. Cooper, secretary-treasurer; Mr. S. W. Cohen, general manager; Mr. M. W. Summerhayes, manager.

The most important development during the year was the picking up of the vein beyond the main south fault. This was accomplished on the 300-foot level where the fault was followed over 90 feet; the vein extension was there picked up and has been followed for 300 feet, showing an average of four feet of $15 ore.

A summary of the development is as follows:

	Prior to 1914.	1914.	Total to date.
Cross-cutting	2,526 ft.	2,471 ft.	4,997 ft.
Drifting	2,104 "	1,674 "	3,778 "
Raising and sinking	1,292 "	488 "	1,780 "
Totals	5,922 ft.	4,633 ft.	10,555 ft.

A diamond-drill hole was put down vertically near the eastern boundary to a depth of 1,100 feet, where about 20 feet of vein material was cut, which, however, showed low values.

The production was as follows: 65,198 tons of ore and 11,554 tons of waste were broken. The mill treated 40,857 tons, leaving a reserve of 24,341 tons on the timbers. The recovery was 97¼ per cent. from ore of an average value of $17.18, giving a gross production of $691,394.29. The net profits of the mine were $349,954; and the dividends paid by the company $240,000.

The continuous decantation process is employed in treating the ore, giving an average extraction of 97.26 per cent. for 1914.

Ore reserves are estimated at 85,000 tons, having a value of $1,510,000.

Porcupine Lake

The Porcupine Lake Gold Mines, Limited, operated during the first half of the year with a force of 20 men under superintendent J. F. Wenstrom. About 300 feet of drifting and cross-cutting was done from the bottom of the shaft, which has a depth of 275 feet on an incline.

Porcupine Pet

The Porcupine Pet Gold Mines, Limited, began operations in the spring on its property in Deloro township.

There are two shafts on the property, 90 feet and 60 feet in depth respectively, and a small mill.

The mill contains an 8 by 12 inch jaw crusher, two 1,900-lb. Nissen stamps, and two Deister concentrating tables. Power is supplied in the mill by a 50-h.p. non-condensing engine. The plant consists of two boilers—50 and 100-h.p., a compressor of 585 cubic feet capacity, and an 8 by 10 hoist.

The drifting and cross-cutting to date amounts to 450 feet, 390 feet of which was done in 1914. The other work during the year consisted of raises 30 feet and 23 feet from the 90-foot level, one of which makes a connection with the 60-foot shaft.

Mr. C. L. Sherrill is president of the company. Mr. H. H. Lavery was superintendent, and was succeeded in October by Mr. A. C. Bailey. The force has varied during the year from 20 to 40 men.

Porcupine Vipond

The Porcupine Vipond Mines, Limited, resumed operations in August. Alterations were made to the mill and a cyanide plant added, whereby the capacity was increased to 90 tons per day, and a great improvement made in the extraction. An outline of the process, as furnished by the general manager, is given below.

The developments underground, in the last quarter of the year, particularly on the 300-foot level, are said to have been satisfactory. The force employed after mining operations were resumed was about 70 men. The development footages for 1914 were as follows: 373 feet of drifts; 82 feet of cross-cuts; and 187 feet of raises; total footages, shaft, 323 ft.; winzes, 22 ft.; raises, 387 ft.; cross-cuts, 1.757; drifts, 902; total, 5,391.

Mr. C. H. Poirier is general manager, and Mr. H. W. Heine, manager.

Following is a description of the mill and cyanide plant:—

Ore is trammed from the shaft house in 14-cu. ft. cars and weighed on Fairbanks track scales; it is then dumped into a small bin from which it is fed into a 10 by 16 Buchanan crusher of the Blake type, driven by a 15-h.p. G.E. motor. From the crusher, which reduces the ore to 1½-inch ring, the ore drops by gravity into the feed hopper of a set of 26 by 15 balanced Sturtevant rolls, crushing to ¾-inch. From the rolls the ore drops into the boot of a 5 by 8 bucket elevator, travelling at the rate of 250 feet per minute and discharging on to a 16-inch belt conveyor which distributes the ore in a 250-ton storage bin. The rolls are driven by a 15-h.p. G. E. motor, and the elevator and conveyor are driven from a line shaft run from a 10-h.p. motor.

From the storage bin the ore is drawn through two James belt feeders and delivered to two 4½-foot Hardinge ball mills. The mills are each driven by a 20-h.p. G.E. motor; each mill is charged with 4,000 lb. of chrome steel balls and revolves at the rate of 27 rev. per min. Five-inch steel balls are added daily, and the consumption is approximately .5 lb. per ton of ore milled. Solution is added to the feed at this point, the ratio being maintained at about 45 per cent. moisture. The ball mills reduce the ore to ¼-inch mesh and finer. About 4 lb. of lime, per ton of ore treated, are added to the ball mills to secure the proper protective alkalinity. Mill solutions are maintained at about 1.2 KCN.

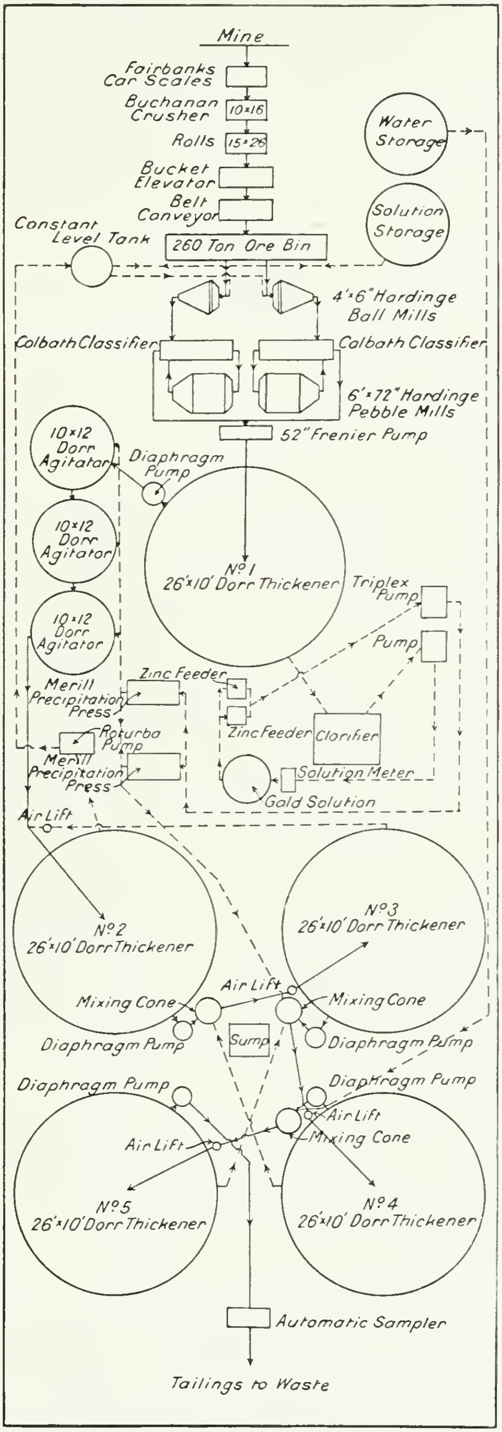
The pulp from each ball mill is further diluted to about 3 of solution to 1 of ore, and drops into two Colbath classifiers, running in close circuit with two Hardinge 6-foot by 72-inch pebble mills. The arrangement is such that any unit can be shut down

Shaft house and mill at Porcupine Vipond

without interfering with the others. The discharge of the classifiers gives about three per cent. on 80-mesh, and 70 per cent. through 200-mesh. The pebble mills are each driven by a 35-h.p. G.E. motor, and run at the rate of 30 rev. per min. Number 4 French pebbles are used, and the consumption is 4½ lb. per ton of ore treated. Mills are lined with silex block lining.

From the classifiers the pulp is led to a 54-inch Frenier pump, which elevates it 12 feet into No. 1 thickener. The overflow from No. 1 thickener, amounting to about 300 tons per 24 hours, is clarified by drawing it through leaves by means of a 7-inch by 6-inch Gould vacuum pump, which discharges into a 6-foot by 6-foot gold solution tank. From the gold tank, the solution, to which zinc dust is added in the proportion of .8 lb. per ton of ore, is drawn through a 5-foot by 7-foot Deming triplex pump and pumped through a Merrill 36-inch precipitation press, of which there are two units.

The underflow from No. 1 thickener, which is 26-foot by 10-foot, is drawn through a No. 5 Gould diaphragm pump which elevates the pulp 12 feet and discharges it into the first of a series of 10 by 12 Dorr agitators, connected in series. The pulp, which is about 35 per cent. moisture, is diluted to 60 per cent. and after passing through the agitators is discharged into the first of a series of four 26-foot by 10-foot Dorr thick-



Flow Sheet, Porcupine Vipond Mill

eners, which are run in the ordinary counter-current way; transfers of the underflow are made by Gould diaphragm pumps and air lifts, the solutions joining the underflows in mixing cones and being thoroughly agitated before discharging into the next thickener. Water is added to the last thickener to replace solution, and barren solution discharging from the precipitation press is added to the next to the last thickener; the overflow of No. 2 thickener is pumped back to mill storage and fed to the ball mills.

The five thickeners, three agitators, pumps and classifiers are driven by a 15-h.p. Westinghouse motor. Air for lifts and agitators is furnished by the mine compressor.

Rea

The Rea or Porcupine Aurum Mines Company, Limited, operated througnout the year with a force of about 35 to 40 men. Mr. David Sloan is manager.

The development during the year amounted to 554 feet on the 200- and 300-foot levels.

The mill treated 11,670 tons of ore, and produced $125,000 in bullion.

Schumacher

The Schumacher Gold Mines, Limited, operated during the first half of the year with a force of 33 men, which was cut down in September to six men, operating one rock drill and a diamond drill. The development for the year was as follows: No. 3 shaft, sinking, 164 feet, and sump, 17 feet; raising, 187 feet, 70 feet of which was into No. 1 shaft, at 55 feet; drifts and cross-cuts on the 100-foot level, 1,085 feet; ditto, 200-foot level, 1,334 feet; ditto, 300-foot level, 190 feet; total, 2,977 feet.

Mr. J. C. Houston is manager.

Three Nations

The Hughes Porcupine Mines, Limited, secured an option on this property in February, 1914, and developed it to the extent of 700 feet of drifting on the ore bodies, 350 feet of cross-cutting, 240 feet of raising, and 40 feet of sinking, or a total of 1,330 feet of development. The ore produced was placed in a stock pile on the surface; no ore was treated except enough for a mill test.

The option on the property was allowed to lapse in August, 1914.

The officers of the Hughes Porcupine Mines, Limited, are: T. Bastien, president; J. W. Blanchet, vice-president; J. Tr. Laurendeau, secretary-treasurer; H. M. Porteous, manager.

Alexo Nickel Mine

The Alexo Mines, Limited, on lot 1, concession 3, Dundonald township, operated during the year, except between August 5th and November 20th, with a force varying from 14 to 24 men. The west drift has been continued to a distance of 280 feet, and the east drift to 150 feet. The ore is shipped to the Mond Nickel Company's smelter at Coniston. The production was about 8,000 tons in 8 months.

A 50-h.p. locomotive-type boiler has been placed beside the 30-h.p. boiler formerly in use. These are used to operate two piston drills and a Hardy plugger drill and the hoist.

Mr. E. F. Pullen, one of the owners, is manager.

Swastika and Kirkland Lake Areas

Burnside

The Burnside Gold Mines, Limited, was operated by the Tough-Oakes Mines for a short period only in 1914, and was closed at the outbreak of the war. The force consisted of 15 men engaged in surface work.

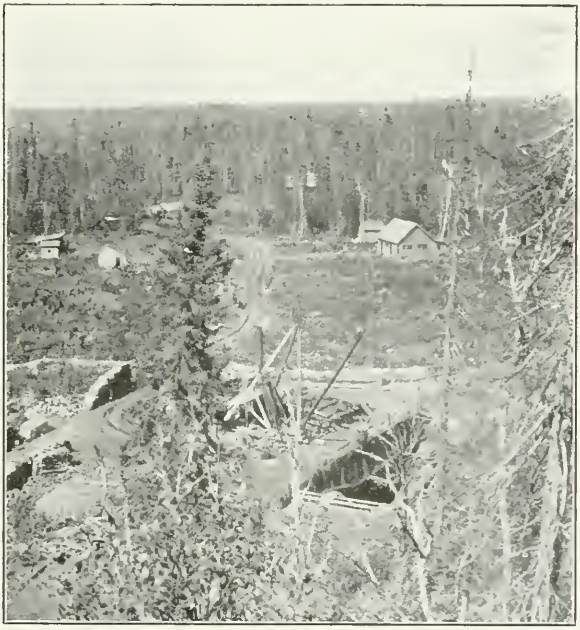
Canada First

The Canada First Mining Company was operating at the end of the year on its property known as the Granow claims, situated at the north end of Long lake in the central part of Lebel township, about seven miles northeast of Dane station. Two prospect shafts have been sunk, one 20 feet and the other 40 feet in depth.

The officers of the company are as follows: Adam Geib, president, Far Rockaway, Long Island, N.Y.; J. C. Lindner, treasurer, 37 Court Street, Buffalo, N.Y.; Wm. Granow, manager, Dane, Ont.

Huronia

La Mine D'Or Huronia, Limited, owns and operates four claims, L2586-7 in Gauthier township, and L2588-9 in McVittie township, with an area of 177 acres in all. The property is distant eighteen miles from Dane, and five miles northwest of Larder lake.



Alexo Nickel Mine

The officers of the company are as follows: Messrs. Chas. Lafond, president; P. V. Ayotte, vice-president; A. Lebrun, N.P., secretary-treasurer, all of Three Rivers, Que.

The mill was run for a short period only in the early part of the summer, owing to scarcity of water for the company's hydro-electric plant, due to a break in the dam, and the dry season which followed. By December 10th a transmission line was completed from the Goldfields mine at Larder lake to the property, and ample power obtained. The bullion production to date amounts to $7,064.

No. 1 shaft has been sunk to a depth of 102 feet, and 12 feet of cross-cutting was done on the 85-foot level. No. 1 tunnel has been driven 300 feet from the bank of the lake towards No. 2 shaft. No. 2 shaft has been deepened from 30 to 75 feet, and 125 feet of drifting has been done on the 50-foot level. No. 3 shaft was down 45 feet at the end of the year, and will be continued to a depth of 102 feet.

Mr. E. H. York is general manager, employing 40 men.

Lake Shore

The Lake Shore Mines, Limited, began operations during the year on the Oakes claims situated along the south shore of Kirkland lake. These claims comprise about 170 acres. Surface work was started in June, and sinking was started in the shaft, which had a depth of 30 feet, in October. This shaft was continued to a depth of 150 feet by the end of the year, and a station cut for the 100-foot level. Sinking has since been continued to a depth of 225 feet, and 130 feet of cross-cuts driven on the 200-foot level.

Commodious log camps had been put up in the previous winter. A power-house 18 by 32 feet was erected during the summer. The plant consists of two 60-h.p. boilers, one 3-drill compressor—capacity 340 cubic feet—and one 6 by 8 hoist.

Mr. Harry Oakes is president of the company; Mr. John W. Morrison is secretary and manager.

The force employed comprises 26 men.

Teck-Hughes

The Teck-Hughes Gold Mines, Limited, operated during the year, except for two or three months in the early summer, with a force of 45 men. During the early months of the year about 500 feet of drifting and cross-cutting was done on the 75-foot level in No. 3 shaft, under Mr. Alex. H. Smith, the consulting engineer of the company.

In July an option was taken on the property by the Nipissing Mining Company, and Mr. H. A. Kee took charge as manager.

The following is a summary of surface and underground work done during the time the Nipissing company had the property under option.

Surface trenching, 4,369 lineal feet, 4.2 feet wide by 6.3 feet deep, or 116,136 cubic feet.

Underground work from August 1st to December 1st, 1914 consisted of 641 feet drifting, 383½ feet cross-cutting, 124 feet shaft sinking, and from December 1st to March 1st, 1915, the work consisted of 186 feet of drifting, 149 feet cross-cutting and 85 feet of winze sinking.

All of the above footage was divided as follows:

No. 1 shaft, 1st level, 356 ft. drifting, 303 ft. cross-cutting
No. 3 shaft, 2nd level, 280 ft. drifting, 120 ft. cross-cutting
No. 3 shaft, 3rd level, 179 ft. drifting, 85 ft. cross-cutting

In addition to this work No. 3 shaft was sunk 124 feet, and a winze was sunk 85 feet from the 2nd level, No. 3 shaft.

Tough-Oakes

The Tough-Oakes Gold Mines, Limited, at Kirkland lake, carried on operations throughout the year. On account of the financial conditions following the outbreak of the war, the force, which had consisted of 250 men, was cut down in the last quarter of the year to 60, when mining operations were suspended pending the completion of the new mill.

Developments have been satisfactory. The "A" shaft on No. 2 vein has been continued to a depth of 322 feet, and the third level, on which considerable work has been done, opened at a depth of 300 feet. "B" shaft on No. 3 vein was sunk to a depth of 124 feet, and 200 feet of drifting done from the station on the first level at a depth of 116 feet. Surface trenching has exposed this vein for 830 feet. No. 6 vein, parallel to and 30 feet north of No. 3 vein, and No. 7 vein, 300 feet north of this again, which were both discovered during the year, have been shown by trenching to contain good ore for lengths of 740 and 245 feet respectively. The other veins, Nos. 8, 9 and 10, were found by trenching during the summer, and each of them shows a fair grade of milling ore where exposed.

Following is a summary of the development work performed during the year, as given in the report of the general manager, Mr. C. A. O'Connell: Shafts, 252 feet; drifts, 862 feet; cross-cuts, 220 feet; raises, 143 feet; stopes, 2,550 tons.

Production was as follows:

Ore shipped to smelters—

Tons	Oz. silver	Oz. gold	Value per ton	Gross value
212.79	6,325.12	3,448.47	$350.53	$74,590.38

Ore milled—

Tons	Oz. silver	Oz. gold	Value per ton	Gross value recovered
3,493.0	309.20	2,075.14	$22.33	$43,053.84

In January a contract was entered into with Mr. K. Farah, owner of Charlton hydro-electric power plant, for a supply of electric power for the operation of the mine. A transmission line, 26 miles long, was completed in April. The power is transmitted at 33,000 volts and is stepped down to 2,200 volts in the sub-station at the mine. The service was interrupted in July, owing to an accident to one of the water-wheels, but since that time there has been a steady supply.

The following buildings were erected during the year: two-storey lodging-house, 80 feet by 80 feet, with accommodation for 200 men; office building, with living quarters on the upper floor, and a fire-proof vault adjoining the main office. The boarding-house was enlarged, and a large main dining-room added. The old office-building was refitted, and is now used as the engineering and draughting office. A residence for the manager was erected and completed during the summer.

All the camp buildings are lighted by electricity, and steam heat is furnished from a Kewanee low pressure, locomotive-type boiler.

The motor compressor plant, situate near "A" shaft, consists of a two-stage Imperial, type 10, Rand air compressor, driven by a 250-h.p. G.M. Westinghouse motor. It delivers 1,670 cubic feet of free air per minute at normal speed.

The drill shop contains a No. 5 Ingersoll Leyner drill-sharpening machine, together with coke furnaces for heating and tempering.

A motor-driven, three-stage, centrifugal pump was installed at Gull lake, and a four-inch pipe line was laid to the tanks on the property. These tanks are each 50,000 gallons capacity, one being located above the camp buildings, and the other at the new mill.

The ore is treated by the cyanide process, using the Dorr system of continuous counter-current decantation.

The mill is located on high ground, 400 feet north of vein No. 2. A brief description of the treatment is as follows:

Ore from the No. 2 and 3 shafts is delivered over an inclined trestle by a self-dumping skip of 30 cubic feet capacity. The ore is weighed on track scales outside of the crusher station. The crusher station is located about 40 feet distant from the mill. The ore from the mine is crushed to 1¼ inch ring in two Blake type Buchanan steel crushers, with intermediate screening. A 14-inch conveyor belt delivers the crushed ore through an inclined conveyor way into the fine grinding bin. This bin has a capacity of 200 tons, and from there the ore is delivered by a short conveyor belt to a 6-foot Hardinge ball mill, crushing in solution. The product of the Hardinge mill is re-ground in two 20 by 5-foot tube mills, and operating in closed circuit with two Dorr duplex classifiers. Amalgam plates are introduced in the tube mill circuit.

The overflow from the classifier, about 85 per cent. of which will pass through a 200-mesh screen, is sufficiently ground for further treatment. This pulp flows from the fine-grinding department into a 30 by 10-foot Dorr thickener in the tank room. The spigot product of this thickener is elevated to three 16 by 10-foot Dorr agitators, where

it receives an agitation of 36 hours' duration. The tests show that 80 per cent. of the values go into solution in the grinding process, and 20 per cent. in the agitator.

From the agitators the pulp is conveyed through a series of four 28 by 10 foot Dorr thickeners operating on the Dorr continuous counter-current decantation system. The pulp is finally discharged to waste from the bottom of the last tank at about 40 per cent. moisture.

The pregnant solution overflowing from the 30 by 10 thickener is clarified through the vacuum filter leaves and precipitated by zinc fume used in conjunction with Merrill triangular frame presses.

A separate refinery-building is equipped with amalgam retort, tilting furnace, and acid treatment equipment.

The mill is heated by steam, and there is a complete machine shop, carpenter shop, lime bin, storehouse and office.

The mill will treat 100 tons of ore per day, and it is expected to be in operation about March 15th.

The Butters-Johnston Engineering Syndicate was engaged in consulting metallurgists, and the erection of the mill is under the direction of Mr. James Johnston.

The annual report of the company gives the following information regarding ore reserves:

	Level	Tons	Value
No. 2 vein	100-foot	10,450	$300,000
	200-foot	9,400	580,000
	300-foot	8,900	140,000
No. 3 vein	116-foot	10,000	320,000
Ore on dumps		7,200	108,000
Tailings impounded		5,200	52,000
		51,150	$1,500,000

The combined average value of the 3,705.79 tons shipped and milled during the year was $41.18 per ton, the average of the high-grade ore being $350.53 per ton, and the recovered value of the milling ore, plus the tailings, being $22.33 per ton.

Stitt Claims

Operations were carried on on the Stitt claims in the last two months of the year. An open cut 45 feet long, and from 6 to 16 feet deep, was made along the vein and a prospect shaft was started in the bottom of this cut. These claims are situated in the centre of Grenfell township, four miles northwest of Kenogami station.

The owners are: J. H. Stitt, Jas. Fraser, Silas Cook, Isabel Graham and G. A. Bagshaw.

Mr. Silas Cook was in charge of operations.

Sylvanite

The Sylvanite Gold Mines, Limited, operated during the first half of 1914, doing surface work only, with a force of 20 men.

Mr. C. A. O'Connell is manager.

SOUTHWESTERN ONTARIO

As stated in the Twenty-third annual Report of the Bureau of Mines, the Province is divided into districts for inspection purposes, southwestern Ontario including all that portion lying south of a line drawn from Toronto to Key Harbour on Georgian bay.

Many questions are asked the inspector as to probable location and quality of certain grades of limestone, clay, etc. In this connection attention might again be directed to the supplementary Reports of the Bureau of Mines for 1904 and 1906. In

Part II of the 1904 Report Dr. Miller describes the limestones of Ontario, their chemical composition, location by townships, and the uses for which they are suited; and Professor Baker, in Part II of the 1906 Report, gives the same information concerning Ontario clay deposits.

Silver Refineries

Coniagas Reduction Company

This company operated its smelter and refinery at Thorold continuously during the year, the only change being the erection of a storage building for cobalt oxide, and an increase in the roasting capacity of the smelter.

The company produce refined silver and arsenic, and the oxides of cobalt and nickel.

Mr. R. L. Peek is superintendent, employing 145 men.

Metals Chemical Company

In the township of Crowland, a short distance outside the town limits of Welland, the above company have been operating for the past year a plant for the treatment of cobalt ores. It consists of one small blast furnace, one roasting furnace, one reverberatory furnace, 15 leaching vats, 7 filter presses, one crystallizing plant, two bag-houses. The plant is electrically operated.

The company produce silver, arsenic, the oxides of cobalt and nickel, and various nickel and cobalt salts.

The officers of the company are: C. S. Richardson, president; J. H. Charles, secretary-treasurer.

K. S. MacLachlan is superintendent, employing 35 men.

Canadian Smelting and Refining Company

This company was organized in October, 1914, and took over the assets of the Canada Refining and Smelting Company, described in the 1914 annual report of the Bureau of Mines. The plant at Orillia has been partially rebuilt, and an additional blast furnace added. The capacity of the cobalt refining department has also been increased and now has a capacity of two tons of oxide per day.

Some low-grade cobalt ores have been purchased, the principal work to date being done with old residues and material left in stock by the former company.

The usual products are shipped, including refined silver and arsenic, and the oxides of cobalt and nickel.

The officers of the company are: J. B. Tudhope, president; George Hayward, treasurer; W. L. Vail, secretary; M. B. Scott, metallurgist; C. Doolittle, superintendent.

Seventy-five men are employed.

Blast Furnaces

The Steel Company of Canada

The pig iron and steel bar trade was very quiet during the year, and as a result the two furnaces operated by the above company at Hamilton were in blast a total of only 367 days in the year. The old blast furnace, "A," has a capacity of 250 tons of iron per day, and the new modern furnace, "B," a capacity of 325 tons per day.

The open hearth plant was operated a total of 182 days during the year.

The efforts of the company's officials along the line of accident prevention, first aid methods, and the general social welfare of the workmen, are again deserving of mention.

The officers of the company remain unchanged. R. Hobson is president and H. Champ treasurer.

Canadian Furnace Company

A full description of the Port Colborne plant of the Canadian Furnace Company, Limited, was given in last year's report of the Bureau of Mines. During 1914 the furnace was in blast from January 1st to September 20th, with a working force of 175 men. Additional yard room has been secured, and a new hoist made by the Brown Hoisting Machine Company of Cleveland has been added to the plant. This hoist is equipped with an electro-magnet disc, 54 inches in diameter, capable of lifting 1,800 pounds of iron. It is used in the stock yards and greatly facilitates the handling of the pig iron.

The officers of the company remain the same as at last report. B. Marron is manager, and D. J. Higgins superintendent.

Gypsum

Caledonia Mine

On lots 10 and 11 in the township of Seneca, first range west of the Hamilton road, the Alabastine Company of Paris, Limited, operated their gypsum mine and plant continuously during the year. When the depression in trade began to be seriously felt, the working days in the mine were somewhat reduced, the men being employed an average of four days each per week. Since last report an additional 50 acres lying north of the present workings have been purchased by the company. This area has been drilled, and the results shown insure a good supply of gypsum for many years. New ground was opened up on what is known as the third level, a distance of 18 feet below the old workings.

On second level the rooms are carried 20 feet wide with 12-foot pillars, and on third level the rooms are narrowed to 18 feet and the pillars carried 14 feet in width.

A. J. Parkhurst is manager of the company, employing 30 men in the mine.

Carson Mine

In addition to the mine at Caledonia, which produces a green gypsum used in the manufacture of land plaster and in cement making to regulate the setting, the Alabastine Company operates the Carson mine at intervals during the year, according to the demand for pure white gypsum and its products.

The mine is located about three miles south of Caledonia village in Oneida township, and the product is teamed to the grinding plant at Caledonia. The gypsum bed is about four feet in thickness, and is worked in the same manner as the Caledonia mine. Overlying the bed of white gypsum are layers of dolomitic shales and limestone, in all from four to six feet in thickness, covered by 40 to 50 feet of post-glacial drift. The roof here is not in as safe a condition as at Caledonia, where the grey beds are from 9 to 12 feet in thickness, overlying which are 40 to 50 feet of dolomitic limestone and shales covered by the post-glacial drift.

Frank Smith is in charge of the mine, employing six men.

Crown Gypsum Company

One-half mile from the village of York on the south side of the Grand river on lots 58 and 59 in the township of Oneida, the above company continued to operate its mine, described in former reports as the Martindale mine. The gypsum here is of the white variety, and the bed is about four feet in thickness. It is mined by the pillar and room method, the waste rock being left underground and built up to support the roof.

The product is hauled from the mine on the company's narrow gauge line to the grinding plant at Lythmore on the Michigan Central railway.

C. E. Williams is manager of the company, and G. C. Fischle, superintendent of the mine, employing 30 men.

Zinc

On lot 30 in the second concession of the township of Albemarle in Bruce county, the Albemarle Zinc Company continued to prospect its property during the year. Work was begun during the summer of 1910, and in 1911 a small shipment of sphalerite was made to Cleveland.

On the date of inspection in August, two men were engaged in trenching, and cleaning out an open pit, which measured 20 feet by 12 feet by 30 feet in depth.

The ore is zincblende, occurring in small pockets in the lime carbonates.

The plant consisted of one 15-h.p. portable boiler, one Rand drill, and a hand winch.

George Bourne, Wiarton, was in charge of the work.

Quarries

Beachville White Lime Company

Near the village of Beachville, in the county of Oxford, the above company quarry limestone for use in the manufacture of lime and for fluxing purposes in blast furnace work.

Two kilns were burning, and a high-grade lime is produced. This rock is also valuable for chemical purposes on account of its low magnesia content.

Chas. Downing is manager of the company, employing 15 men.

Coast and Lakes Contracting Corporation

In Bertie township, county of Lincoln, about six miles from the village of Ridgeway, the above company quarry limestone. The quarry has been in operation for a number of years, and was formerly owned and operated by the Breakwater Quarry Company.

The plant comprises 5 portable locomotive boilers, 9 guyed derricks, 8 Ingersoll Rand drills, and a number of pumps. The stone is quarried in 10-ton blocks and hauled on the company's standard gauge line one and a quarter miles to the dock on Lake Erie, for delivery along the lake to various United States Government breakwater contracts. The officers of the company are: D. J. Boylan, president, New York; M. E. Gloven, manager, Ridgeway.

Ninety-seven men were employed on the date of inspection in September.

Canadian Quarries, Limited

On lots 28, 29 and 30, in the fifth concession of the township of Saltfleet, Wentworth county, the Canadian Quarries, Limited, continued to operate its limestone quarry during the year. The plant consists of: one 35-h.p. horizontal boiler, one 25-h.p. portable boiler, one 40-h.p. horizontal boiler, one 10-h.p. upright boiler, one No. 6 Austin gyratory crusher, one No. 4 ditto, one 6-section revolving screen 24 feet long by 4 feet in diameter.

Crushed stone only is shipped.

D. D. O'Connor is president of the company, and R. S. Stone manager and secretary, employing 40 men.

Cook Quarry

On lots 7 and 8 in the twenty-fourth concession of the township of Annabel, county of Bruce, Mr. J. S. Cook quarries limestone for use in the building trade as sills, and dressed stone as lintels and coursing. The plant consists of a small 5-h.p. gasoline engine and air compressor, drilling for plug and feather work being done by pneumatic tools.

Five men were employed by Mr. Cook.

Canada Cement Company

On lots 30, 31 and 32 in the township of Humberstone, county of Welland, near the town of Port Colborne, the above company operated their limestone quarry and cement plant continuously during the year. The plant in the quarry consists of 2 60-ton Marion shovels, 4 dinky locomotives, 1 Browning clam shell hoist, 1 Cyclone drilling machine.

S. R. Preston is manager, employing 35 men.

Canada Crushed Stone Corporation

On lots 12 to 16 inclusive, first concession of the township of West Flamborough, near the town of Dundas, the above company operated their limestone quarry continuously during 1914. The crushing plant has the greatest capacity of any in the Province, and in addition to the crushed product, large shipments of building stone are made. The quarry has on one side a working face of 50 feet, the overburden for several acres in extent being stripped by a steam shovel.

C. M. Doolittle is president of the company, and J. D. Small superintendent, employing 60 men.

Chalmers Quarry

This quarry in Owen Sound, owned and operated by David Chalmers, worked at intervals during the year, according to the demand for white lime. All the stone quarried is burned to lime in a 400-bushel kiln. When the quarry is in operation Mr. Chalmers employs 10 men.

Fleming Quarry

In the ninth concession of the township of Esquesing, near the village of Glen Williams, county of Halton, J. Fleming operated his quarry during the year. The whole output is shipped as dimension and building stone, and the waste as rubble. The plant includes one 25-h.p. upright boiler, one Marsh and Henthorn hoist, and one guyed derrick with a 60-foot mast and 45-foot boom.

M. G. Bell is in charge of the quarry, employing 20 men.

Empire Limestone Company

On lots 4 to 6 in the first concession of the township of Humberstone, near Sherkston station on the Grand Trunk railway, the above company operated their limestone quarry with reduced force during 1914. Drilling was stopped September 1st, and work in the quarry after that date confined to cleaning up broken material, and crushing for a county road contract. The loading of sand on the shore of lake Erie was continued during the season of navigation, with an average output of 700 yards per day.

Some 60 men were employed on the date of inspection in July. John Haston succeeded T. R. Thomas as manager early in the year.

Gallagher Lime and Stone Company

On lot 15, in the sixth concession of Barton township, the above company quarries limestone for use in the manufacture of lime. Some dimension and rubble stone is also supplied to the local trade in Hamilton.

Dan. A. Gallagher is manager of the company, employing 10 men.

Hagersville Contracting Company

On lot 14 in the thirteenth concession of Walpole township, near the village of Hagersville, the above company continued to operate their limestone quarry. The plant consists of two 60-h.p. Waterous boilers; one 150-h.p. gas engine; one 60-h.p. gas engine; one No. 5 Austin crusher; two Gates crushers.

J. C. Ingles is manager of the company, employing 40 men in the quarry and 5 in the crushing plant.

Harrison Quarry

In the town limits of Owen Sound, Mr. H. B. Harrison operated his limestone quarry during the year, producing rubble, crushed and building stone, chiefly for the Toronto market.

The plant includes one Marsh and Henthorn double drum hoist; one portable locomotive boiler; one 30-h.p. upright boiler; 3 guyed derricks.

About 45 men are employed.

E. Harvey, Limited

Near the village of Rockwood, Messrs. E. Harvey, Limited, operated their limestone quarry during the year. The working face has an average depth of 35 feet, and the whole product is burned to white lime in three large kilns. Hydro-electric power is used to operate the quarry machinery and kiln fans.

E. Harvey, Guelph, is manager, employing 25 men.

Logan Quarry

On lot 27, in the eighth concession of Esquesing township, about three miles north of Georgetown, Mr. Hugh Logan operated his limestone quarry during the summer months. The product is sold as dimension and rubble stone, shipment being made by Grand Trunk Railway which runs near the quarry.

About 35 men are employed.

Longford Quarry Company

At Longford Mills in Rama township, about seven miles south of Orillia, the Longford Quarry Company operated its limestone quarry during the summer months. With the exception of a few labourers all the workmen are expert stone cutters, and the whole product of the quarry is sold as dimension stone.

William Thomson, Orillia, is president and John Meikle superintendent, employing 25 men.

Marshall Quarry

On lot 14, in the seventh concession of Barton township, Mr. James Marshall quarries limestones for use in the manufacture of lime. Two kilns are kept burning during the summer months, and 25 men are employed.

Oliver-Rogers Quarry

In the town limits of Owen Sound the Oliver-Rogers Stone Company, Limited, operate the limestone quarry formerly known as the Oliver-Webster quarry.

The plant consists of three guyed derricks; one stiff-leg derrick; one Thew steam shovel; one 15-h.p. portable boiler for drilling; one No. 4 McCully crusher, screening plant and storage bins. The quarry worked throughout the year, shipping rubble and crushed stone. Mr. S. J. Oliver is president and manager of the company, employing 30 men.

Owen Sound Lime Works

On the west side of Owen Sound, Mr. O. C. Brown quarries limestone for the manufacture of lime. During the year the kilns were arranged for gas firing, on account of the increasing cost and scarcity of wood. The corporation of the town of Owen Sound installed a small crushing plant in the quarry and purchased stone for municipal use.

Queenston Quarry Company

On lots 47 to 49, in the first and third concessions of Niagara township, the above company operates one of the largest quarries in the Province.

Building stone is supplied to the trade, also crushed stone for use in concrete and road construction.

The plant was described in the twenty-third annual report of the Bureau of Mines, and remains same as there reported.

Charles Lowrey is president and manager of the company, employing 100 men.

St. Marys Portland Cement Company

This company has operated its limestone quarry and cement plant continuously since operations began in 1912. A commendable feature of the work here is the interest shown by the officials of the company in the social welfare of their employees and in the means taken to safeguard the men and prevent accidents. The plant was described in the twenty-third annual report of the Bureau, and remains unchanged.

The officers of the company are: Geo. H. Gooderham, president; Mark Irish, secretary; J. G. Lind, manager.

Some 40 men are employed in the quarry and clay pit.

St. Marys Horse Shoe Quarry

This quarry in the town of St. Marys, near the cement plant, has been worked for a number of years, and is now owned and operated by Mr. R. H. McWilliams.

Work is carried on during the summer months only.

Standard Crushed Stone Company

This company was formerly known as the Power City Crushed Stone Company, and during the year continued to operate the limestone quarry near St. David, and opened up a new one near Ridgeway in Bertie township.

The St. David quarry is located on lot 44, in the township of Niagara, near the Queenston quarry. The plant here consists of 1 Bury straight line compressor, 300 cu. ft. capacity, two dinky locomotives, one No. 5 Gates crusher, revolving screens and storage bins. On the date of inspection, in July, 40 men were employed.

Near Ridgeway, the company built a crushing plant and opened up a limestone quarry for supplying crushed stone to the county of Lincoln for road material. The plants at both quarries are electrically operated.

The officers of the company are: John Symmes, president; Robin Boyle, secretary; J. H. Barbeau, superintendent.

Standard White Lime Company

This company is probably the largest producer of white lime in the Province. It operates quarries and kilns at St. Marys, Guelph, and Beachville.

At what was formerly known as the Sclater quarry, in St. Marys, two kilns are operated, this being their smallest plant. In Puslinch township, west of the city limits of Guelph, there are three kilns, with a combined capacity of twenty tons of lime per day. Here also is located a large plant where hydrated lime is manufactured. In the city of Guelph two kilns are in operation. At Beachville, near Ingersoll, there are five kilns, with a capacity of 50 tons daily. Up to September 1st, 1914, this quarry was operated under lease by Messrs. Cumming and Wallace. After that date the company took it over and placed Alfred Cropp in charge.

D. D. Christie is president of the company, and J. Kennedy manager.

Toronto Lime Company

This company continued operations at its Limehouse and Dolly Varden quarries, in the township of Esquesing. The stone burns to a high-grade white lime, and the four kilns in operation at the two quarries have a combined capacity of 45 tons of lime per day.

William Gowdy is manager, employing 40 men at Limehouse and 25 at Dolly Varden.

Thames Quarry Company

This company operated its quarry at St. Marys during the summer months.

The plant and quarry were described in the twenty-third annual report of the Bureau, and no change occurred during the year.

Mr. David Bonis president and manager, employing 40 men.

Wentworth Quarry Company

On lot 4 in the fifth concession of Saltfleet township, the above company continued to operate its limestone quarry, shipping crushed stone only. Drilling is done by a cyclone churn drill, drilling a hole 4 inches in diameter. For blasting 60 per cent. CXL dynamite made into cartridges 3 inches in diameter is used.

The broken rock is loaded into cars by a model 61 Marion steam shovel.

The crushing plant includes one No. 7½ McCully crusher, one No. 5 McCully crusher, one 6-section revolving screen 20 feet in length by 4 feet in diameter. The plant is driven by a Duddbrige, twin-cylinder gas engine supplied by a 115-h.p. gas producer plant.

F. W. Schewendiman is manager, employing 25 men.

Welland County Lime Works

What was formerly known as the Reeb quarry and lime works in Wainfleet township, about 3 miles west of Port Colborne, is now operated under lease by John Rolph, of Toronto, the work being in charge of John Rolph, Jr., manager of the Imperial Bank, Port Colborne. The lime kiln has a capacity of 10 tons per day, and in addition to white lime, shipments of crushed stone and rubble are made.

The plant includes one 25-h.p. upright boiler, two 25-h.p. each portable locomotive boilers, one No. 3 Austin crusher, revolving screens and conveyors.

Ben. Rathfon is foreman, employing 10 men.

Thorold

In the vicinity of Thorold several quarries were worked on a small scale, supplying stone to contractors on the new Welland canal. Formerly some of the largest quarries in the Province were operated here, but the business gradually died out.

Messrs. David Walker, David Battle and William Cartmell quarried stone during the summer months, and during the coming year it is expected that operations on a larger scale will be commenced.

Willicks Quarry

In the township of Bertie, near the village of Ridgemount, Mr. William Willicks quarried and crushed limestone for township road construction. The plant includes one threshing engine, one climax road-crushing plant, one stiff-leg derrick, one revolving screen.

This quarry worked during the summer months, giving employment to 15 men.

V.—EASTERN ONTARIO

During 1914 little change was noted in the mining industry in eastern Ontario.

The iron mines owned by the Canada Iron Mines, Limited, in Hastings county were closed during the year, also the Belmont mine, operated during the previous year

by the Buffalo Union Furnace Company. The large supplies and consequent low price of pig iron at the close of 1913, accounted largely for the decreased iron ore production.

Following closely upon the outbreak of hostilities in Europe, the Canada Cement Company closed their Belleville plant, but continued operations at Port Colborne.

Shipments of crude feldspar to the United States remained normal, a small quantity being produced in Burgess township, in addition to an average production from the Richardson properties in Bedford township. There is a possibility that the coming year will show increased activity in the prospecting for and development of feldspar properties as a source of potash for fertilizer purposes. Hitherto, owing to the pottery trade refusing everything but the highest grade spar, many properties were unable to meet the requirements, except at a prohibitive cobbing cost. Owing to recently-devised methods of reducing the potash content to a soluble condition, these low-grade spars may be mined at a profit.

Shipments of refined talc show an increase over 1913, the crude talc to New York trade being about one-third less. This industry is now on a firm basis, and the mine and mill at Madoc ran to full capacity throughout the year.

The increased demand for molybdenite and consequent higher price drew attention to that mineral, and to eastern Ontario as a probable source of supply.

The Algunican Development Company did some prospecting and development work on a molybdenite property in Brome township. A shaft was started and preparations were being made to instal a good-sized plant, when the war started and operations ceased.

In Frontenac county the Olden zinc mine, owned by H. W. Richardson, of Kingston, has been leased, with option to purchase, to the Long Lake Zinc Company. The old workings have been de-watered, sampled and mapped, and there is every possibility of this mine again entering the producing class.

Iron Pyrites

At the Nichols Chemical Company's mine and acid works, at Sulphide, in the township of Hungerford, Hastings county, work in the mine was confined to stoping on the three upper levels, no sinking or new development work being performed.

The equipment at the mine and acid works remains the same as at last report.

Seymour electric power is used throughout the mine and plant.

Good results have been attained by the management of this company in systematic work for the prevention of accidents.

On the date of last inspection 33 men were employed at the mine and 75 at the acid works.

W. H. DeBlois is superintendent.

Queensboro Mine

The Canadian Sulphur Ore Company operated its mine in Madoc township continuously during the year, and the production of pyrites showed a large increase, due to steady development underground.

At last inspection the main shaft, No. 3, had reached a depth of 200 feet, with sinking in progress.

On the second level the west drift was extended to 200 feet and the east drift to 250 feet. On the third level the west drift had reached 130 feet and the east drift 200 feet.

Three raises from third to second level were driven, and stoping commenced on third level.

A. B. Willmott, manager of the company, died in May, 1914, and was succeeded by Geo. H. Gillespie as vice-president and managing director.

Walter Coleman is superintendent, employing 45 men.

Craig Mine

As noted in last year's report, this mine was operated during 1913 by the Sulphide Chemical Company, of Toronto, and closed down in November of that year. Since that date no work has been done.

Iron

The iron mines of Hastings county were not operated during the year 1914.

The Belmont mine, near Cordova, owned by the Buffalo Union Furnace Company, closed down early in the year, and no shipments were made. It is expected that the manager, Mr. Frank Platto, will return to the mine in April, 1915, and that operations will be resumed.

The Bessemer and Childs group of mines near L'Amable station on the Central Ontario railway, owned by the Canada Iron Mines, Limited, were also closed throughout the year. A considerable quantity of ore from this property was shipped to the concentrator at Trenton during 1913, and work was continued there during part of 1914, some 13,000 tons of concentrates being shipped.

Gold

Cordova Mine

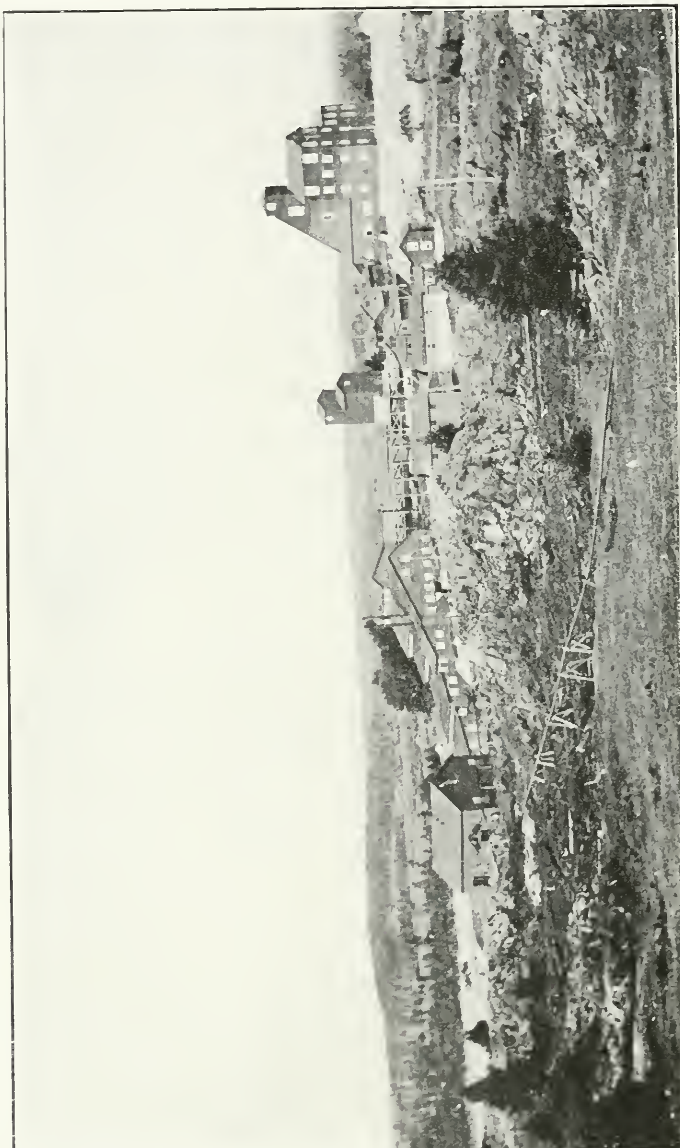
As noted in last year's report, this mine closed down in August, 1913. During the summer of 1914, P. Kirkegaard and associates resumed operations, and made extensive alterations and additions to the stamp mill. Power shortage caused considerable trouble throughout the balance of the year, hoisting being done on day shift, with mill running night shift. Plans for further development of the ore bodies have been made, and it is expected that during 1915 this mine will be found among the steady gold producers of the Province. Sixty men were employed on the date of inspection.

P. Kirkegaard is managing director of the operating company known as Cordova Mines, Limited. F. Oliver is manager. Capt. J. C. Stacey has charge of the underground work.

Many improvements and additions to plant were made at Cordova mine during the last half of 1914 and the beginning of 1915. No. 1 shaft-house is a large substantial frame building. In it have been installed two large gyratory rock breakers and a number of conveyor belts for handling the broken ore from shaft to mill.

The ore is hoisted from the mine in self-dumping skips and emptied into an ore bin. Below this bin is a bumping table, serving the dual purpose of sorting table and conveyor between the ore bin and the first crusher. This bumping table is suspended from six 1½-inch rods, and is given about 1½-inch stroke, 160 per minute. The table is divided into three parts, each 20 inches; on the two outside divisions the sorting is done, the central part receiving the waste and delivering it automatically to the dump. Two men handle all the ore, amounting to 150 tons in 10 hours. The ore is crushed in first gyratory breaker to 3-inch ring, then conveyed on 30-inch rubber belt to smaller gyratory, where it is crushed to 1½-inch ring; from there it is conveyed in three stages to the 30-stamp mill, a distance of about 600 feet. The discharge end of belt conveyor at mill drops the ore on a sampler which cuts out 10 per cent. of the ore-stream. This 10 per cent. drops into a smaller hopper, whence it is fed to a 7-inch by 10-inch jaw crusher, reducing it to ½-inch ring. This product flows to another sampler which makes a five per cent. cut. This again is crushed to about 40-mesh, and a Jones sampler cuts it in halves. All rejects go to the ore bin, and the final samples to the assay office.

In the 30-stamp mill several improvements have been made, the most notable being the addition of a 5-ft. by 22-ft. tube mill, a set of cone settlers, and a small Pachuca agitator. The 30 stamps were originally 850 lb. each; 20 stamps remaining this weight crush to 40-mesh. The pulp flows over amalgamating tables, where about 60 per cent. of the gold value is recovered; the table tails flow to Wilfley tables, where about seven per cent. by weight is caught as concentrates; these are cyanided, making a further recovery of about 30 per cent. of the original assay value.



General view Cordova Gold mine

The other ten stamps, which have been increasd to 1,000 lb. each, crush through a 6-mesh screen, the pulp flowing to a screw conveyor de-waterer, and the oversize going direct to the mill; the slime overflow to a set of amalgamating tables below the tube mill, and joining the pulp from the tube mill, which is 80-mesh and finer. The middlings from the Wilfley tables below the 20 stamps are returned to the same de-waterer, and thus added to the pulp from the tube mill 10 stamps, giving the tube mill a duty of 100 tons per 24 hours.

The tube mill pulp after leaving the amalgamating tables below the tube mill is classified in cones, the overflow going to tails, the spigot to Wilfley tables; the concentrates from these are treated in Pachuca tank. Recovery is 90 to 91 per cent. of assay value.

Other improvements consist of an addition of an electrical unit at the power plant, i.e., a 400-h.p. double turbine, to which is directly coupled a 250-k.w. generator; current from this 2,200-volt is conveyed over aluminum cables a distance of 3½ miles to the mine, and is there used for driving motors.

All machinery in No. 1 shaft house—" crushers and conveyors "—are motor-driven, and the 30-stamp mill has been changed from steam to motor-drive.

It has recently been decided to change the whole power plant to electric; a 500-k.w. generator will be directly connected to an 800-h.p. double turbine, the current, stepped up to 6,600 volts, conveyed over the now existing power line, and at the mine transformer station stepped down to 2,200 volts for motor drives. Two air compressors with a joint capacity of 3,600 cu. ft. per minute will be installed.

These changes will bring Cordova mine plant up to date, and will greatly reduce the working cost. With the changes already made, the cost has been brought down to about $2.25 per ton; with the electrical additions it is believed that the cost will be reduced to $2.00, or a little less.

Golden Fleece

The Golden Fleece mine has had the usual varied experience of gold properties in eastern Ontario. During 1913, as described in the twenty-third report, this mine was under option to the A. B. P. Mining Company. Operations were suspended by this company during the summer of 1913, and no work was done during 1914.

Ore Chimney

The Ore Chimney Mining Company did considerable development work on its property in Barrie township during 1914. The power plant was improved by the addition of two 100-h.p. horizontal tubular boilers.

A new shaft-house and head frame were built, also boiler-house and engine room, dry for workmen, and large boarding-house.

The shaft at last inspection had reached a depth of 261 feet. During the last six months of the year the following work was performed:—sinking, 56 feet; second level, drifting, 130 feet, and cross-cutting 49 feet; third level, drifting 334 feet, and cross-cutting 29 feet.

The ore is a mixture of zincblende and galena, with some chalcopyrite.

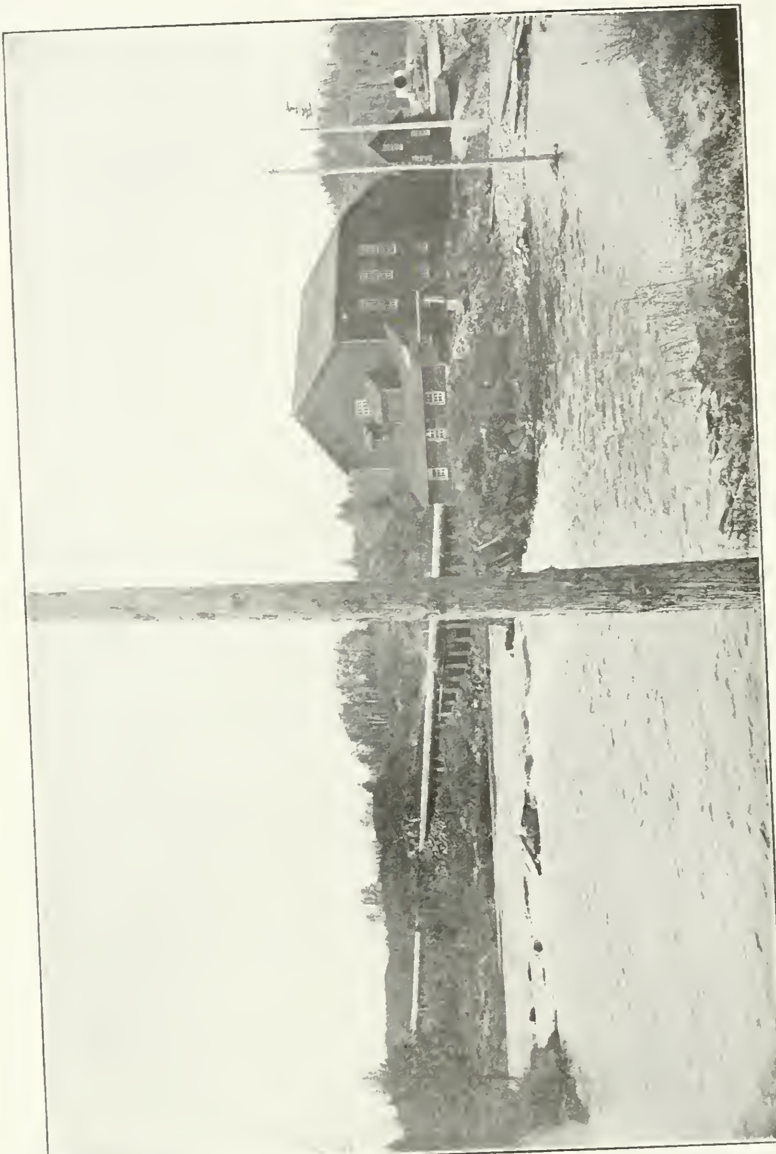
A 20-stamp mill was recently purchased in Nova Scotia, and will be erected on the property.

The officers of the company are: D. E. Fletcher, president, Hamilton; Chas. Narraway, secretary, Hamilton; W. G. Anderson, manager, Northbrook.

Ore Extension

The Ore Extension Mining Company began work in June, 1914, on the N.W. ¼ of lot 27, concession 7, Kaladar township.

A two-compartment shaft, slightly inclined from vertical, had been sunk to a depth of 43 feet at time of inspection. The shaft is sunk in the schists, the country rock of the district.



Cordova Mines power plant at the outlet of Deer lake

Drilling is done by hand, and hoisting by horse whim and bucket.

Wm. Atkin, of Northbrook, was in charge of the sinking operations, employing two men. The officers of the company are: David Fritz, president, Vineland; L. R. Lupton, secretary, Vineland.

Pay Ore Mines

The Pay Ore Mines, Limited, began work in the fall of 1914 on lots 35 and 36, concession 1, Barrie township.

A shaft 7 feet by 11 feet had been carried to a depth of 66 feet, with sinking in progress under superintendent R. A. Johnson. Drilling was done by hand, and hoisting with horse whim. Six men were employed.

The officers of the company are: B. O. Johnson, president, Buffalo; W. W. Johnson, secretary, Buffalo.

Ore Mountain

The Ore Mountain Mining Company, Limited, is prospecting lot 32, concession 1, Barrie township. On the day of inspection a vertical shaft 7 feet by 11 feet had been sunk to a depth of ten feet by contractor Charles Rosenplot, employing 8 men.

A single-drum Napanee hoist has been installed, steam being supplied by a portable boiler.

The officers of the company are: D. A. Fletcher, president, Hamilton; J. H. Myers, secretary, Hamilton.

Talc

Henderson Mine

The Henderson talc mine, operated under lease by Messrs. Cross and Wellington, of Madoc, worked continuously throughout the year. No. 1 shaft has a depth of 250 feet, and No. 2 96 feet.

The mine is now being worked on the retreating, slicing and caving system, and all work done during the year was in preparation of this change in method of working. A main drift 340 feet in length was driven to the foot wall from No. 1 shaft, and five raises put through to second level. In this manner a large tonnage was developed, and an increased production is anticipated for the coming year.

Stephen Wellington is in charge of the mine, employing 15 men.

Gillespie Mill

The talc grinding plant, owned by Messrs. Geo. H. Gillespie and Company, situated near the Grand Trunk railway station, Madoc, purchased a large proportion of the output of the Henderson mine.

Before the war broke out the company had a large European trade for refined talc, and the partial loss in this direction was off-set by an increased business with the United States, enabling the mill to work to full capacity throughout the year. The plant comprises 4 50-h.p. motors, 2 35-h.p. motors, 2 rock breakers, 2 dryers, 4 36-inch Sturtevant emery grinders, 1 48-inch horizontal do., 2 tube mills, 2 Newaygo separators, 2 gyrators, 4-stage sifters, 8 2-box rotary sifters, 7 hexagonal reel sifters, 3 automatic packers, 6 hand packers.

George H. Gillespie is manager, employing 25 men.

Eldorite, Limited

Eldorite, Limited, formerly the Canadian Talc and Silica Company, continued to operate its mine and mill near Eldorado station, on the Central Ontario railway, in Hastings county.

The company was re-organized in March, 1914, and extensive improvements and additions were made to the grinding plant.

The officers of the new company are: Sir Douglas Haig, president, England; J. A. Haig, managing director, England; Capt. Waddell, secretary, Toronto.

Robert Phillips was in charge of the property, employing 20 men.

Lead

Frontenac Lead Mine

The Frontenac lead mine in Loughborough township, owned by the North American Smelting Company, Kingston, remained closed throughout the year. The lead smelter at Kingston owned by the same company closed down in November, 1913, and remained closed during 1914.

Kingdom Mine

On lot 22, in the sixth concession of the township of Fitzroy, a promising lead prospect has been opened up during the past year. Some thirty years ago lead was discovered on Chat island about two miles west of Galetta station on the Grand Trunk railway, and more recently, practically the whole island was acquired by the late James Robertson of Montreal, and the administrators of his estate are the present owners and operators.

About 200 feet from the old workings (which consisted of a 50-foot shaft) the present operators have sunk a two-compartment shaft to a depth of 112 feet, and drifted 400 feet east and west on the vein.

The shaft is vertical to 60 feet and from that point inclines about 15 degrees from the vertical.

The ore is galena in a calcite gangue, and can be easily concentrated on jigs and tables. At present there are about 5,000 tons on the dump ready for concentration when the mill is completed.

The plant consists of one 12-h.p. upright boiler, one 50-h.p. locomotive, one 175 cu. ft. air compressor, one Knowles pump, two No. 5 Cameron pumps, one Jenckes hoist.

A concentrating mill 75 feet by 30 feet is in course of erection, and by August 1st, 1915, the company expects to be producing lead concentrates.

Mr. A. G. Munich is general manager, employing 20 men.

Feldspar

Richardson Mine

The Kingston Feldspar and Mining Company shipped steadily during the season of navigation. This mine is the largest shipper of feldspar in Canada. Ore from the Desert Lake mine is shipped in scows across Thirteen Island and Thirty Island Lakes to Glendower siding, Canadian Pacific railway, and transhipped at Kingston to boats for the grinding plant at Charlotte, port of Rochester.

The ore from the Reynolds mine, owned by the same company, is hauled to the Canadian Pacific railway siding at Verona, and stock-piled for all-rail shipments to the pottery trade in Ohio.

About 18,000 tons of high-grade spar are produced yearly.

H. W. Richardson, Kingston, is president and general manager of the company.

Smith Mine

On lot 13, fifth concession of the township of Burgess, Edward Smith mined a small amount of feldspar during 1914, shipment being made by boat on the Rideau canal to Ottawa. The ore was taken from a circular open pit about 30 feet in diameter and 10 feet in depth. About 800 tons of feldspar were shipped from this property in 1914.

Feldspar Grinding Plant

The Dominion Feldspar Company, Limited, operated its grinding plant near Parham station, on the Canadian Pacific railway, during the first six months of the

year. The plant consists of 1 Sturtevant jaw crusher, 1 Kent mill, separator, screens and elevators, 1 125-h.p. horizontal tubular boiler, 1 Leonard Corliss engine 14 x 30.

The plant has a capacity of 10 tons per shift of 10 hours.

A. Richardson, Toronto, is manager, and T. Reeves is in charge of the plant, employing 4 men.

Mica

That the mica industry in Eastern Ontario was formerly of much more importance than at present can be gathered by a comparison of annual reports of the mineral production of Ontario for the past twelve years. The Report of the Bureau of Mines for 1903 contains descriptions of thirteen producing properties, chiefly in Frontenac and Lanark counties. About that time the market opened up for the smaller sizes, such as the one by two-inch grade, formerly thrown on the scrap-heap. This gave a decided impetus to the industry, and for several years old discarded dumps were carefully worked over, and prospecting for new veins continued.

Although mica mining has never proved attractive for the larger companies, there appears to be no valid reason why small amounts of capital invested in systematic prospecting should not result in the discovery of valuable deposits of this mineral.

In 1914 production fell off to about 350 tons, and prices were lower than for some years previous.

Lacey Mine

The Lacey mine, situated in Loughborough township, about four miles from the village of Sydenham, and owned by the Loughborough Mining Company, a subsidiary of the General Electric Company, is the largest producer of mica in the Province. It has been described for many years in annual reports of the Bureau of Mines, as a steady producer of high-grade mica. The product is rough-trimmed at the mine and shipped to the company's trimming plant in Ottawa for thin-splitting and finishing.

Very little new work was done during the year on account of decreased demand for stock. The open pit worked during the summer months is now about 80 feet by 75 feet by 100 feet in depth. The main shaft has been carried to the 175-foot level with a 10-foot sump, the largest production being derived from what is known as the milky vein on the seventh level.

A large stock is carried at the mine to meet any sudden demand, and mining operations during the year, outside of occasional work in the stopes, were confined to retimbering, scaling, trimming pillars, and making necessary changes in the shaft.

George McNaughton is manager of the company, and R. H. Smith superintendent, employing 30 men.

Frontenac Mine

The Frontenac Mica Company began operations in the spring of 1914, on lot 10 in the eighth concession of Loughborough township. On the date of inspection a vein of phlogopite had been stripped and worked by open pit to a depth of 30 feet. The pit was 20 feet across at top, with sloped banks, and in this manner about 50 feet of the vein matter had been mined. The vein had been traced and partly stripped for a distance of 500 feet.

The plant consisted of one 25-h.p. upright boiler, one McKinnon-Terry drill, one stiff-leg derrick.

The officers of the company are: S. A. Wookey, president, Sydenham; A. D. Emery, secretary, Toronto.

Twelve men were employed under Mr. Wookey.

Taggart Mine

The Taggart mine, owned by Messrs. Kent Bros., of Kingston, and Mr. J. M. Stoness, is situated on the west shore of Bobs lake in Bedford township.

Since 1903 it has been a steadily increasing producer of high-grade amber mica, but was worked for a short time only in 1914, owing to the decreased demand and large stocks on hand at the beginning of the year.

All the product is shipped to Messrs. Kent Bros.' trimming plant at Kingston. A small force has been kept at work during the summer, prospecting on the Stoness property near the Taggart mine, under the direction of J. M. Stoness.

Scott Mine

This mine is situated on lot 7 in the ninth concession of Bedford township, on the south shore of Devil lake.

During the year it was operated steadily, and a ready market found for the product. Messrs. Stoness and Anglin purchased Mr. Geo. Gilbert's interest in the property, and erected a trimming plant at Kingston, to which the mica is shipped in the rough and finished for the market.

Trimming Works

The following firms are engaged in trimming and thin-splitting mica in Ottawa:

General Electric Company.

Laurentide Mica Company.

Eugene Munsell and Company.

Mr. S. O. Fillion.

Mr. R. Blackburn.

Wallingford Mica and Mining Company, and in Kingston Messrs. Kent Bros. and Messrs. Stoness and Anglin.

Legree Molybdenite Mine

In the township of Denbigh about 25 miles from the town of Renfrew a New York company is working the above mine under option from Mr. J. Legree of Renfrew.

The molybdenite occurs in large flakes in the gangue, and about 1,200 pounds have been hand-sorted and shipped. On account of the attractive price now being offered for this material, operations on a larger scale will be carried on during the year.

Mr. George R. Grey is in charge of the work, employing 10 men.

Graphite

Black Donald

The Black Donald Graphite Company operated its mill continuously during the year, and the mine from May 7th to October 14th. During this period sufficient ore was mined to run the mill throughout the year.

The mine and mill are located on the shore of Whitefish lake, about 14 miles from Calabogie, and comprise lots 17 to 20 in concessions 1, 2 and 3, Brougham township.

During the year the old method of hoisting by bucket and skids was abandoned and a skip track put in. The workings have now reached a depth of 130 feet, extending 90 feet under the lake. A vein of graphite 16 feet in width is being worked.

During the year about 2,600 tons of crude ore were mined, the milled product being bagged and hauled by team to Calabogie.

The officers of the company remain same as last report. On the date of inspection 46 men were employed under superintendent Mr. J. Patno.

Tonkin-DuPont

The Tonkin-DuPont Graphite Company is successor to the Virginia Graphite Company, having been organized in July, 1913, with a capitalization of $2,000,000. The shares have a par value of $100 each. All the assets of the Virginia company were taken over by the present concern, of which Mr. J. J. Tonkin is president and Mr. M. DuPont, treasurer.

Several graphite prospects in Monmouth township, Haliburton county, and in Cardiff township, Hastings county, have been opened up and the ore treated in the company's mill at Wilberforce. A high-grade flake graphite for use in the manufacture of crucibles is produced from this ore.

Mr. H. G. Tonkin, Wilberforce, is manager of the mine and mill.

Silver Refinery

Deloro Mining and Reduction Company

Cobalt ores were smelted at this plant during 1914, the capacity of the plant being almost doubled during the year. At present fine silver, arsenic, cobalt oxide and nickel oxide are produced, and furnaces are being installed for the production of cobalt and nickel in the metallic form. The aim of the company is to finish all products at the Deloro plant, and ship only in the refined state.

The officers of the company are: M. J. O'Brien, president; Thos. Southworth, vice-president; S. B. Wright, general manager.

Corundum

The Manufacturers Corundum Company continued to operate its property in Carlow township, Hastings county, including the mill at Burgess Mines, formerly owned by the Ashland Emery and Corundum Company. All the corundum is mined by open-cut methods on account of the limited depth to which it has been found to occur. This necessitates frequent moving of plant, building new roads, magazines, etc.—a fact which does not conduce to care in the handling of explosives.

The ore, after being crushed and pulverized, is run over Wilfley tables, then dried, screened and sized for the three Hooper jigs. The jig product is graded for shipment in 100-pound sacks.

The officers of the company are: E. B. Pike, president; A. W. Holmested, secretary; D. A. Brebner, managing director.

E. B. Clarke is superintendent, employing 60 men.

Standard Blast Furnace

The Standard Iron Company, Limited, operated their blast furnace at Deseronto from March 1st to August 22nd, 1914. The furnace and plant were practically renewed in the fall of 1913, and have now a capacity of 80 tons of charcoal pig iron per day. The Parry Sound plant owned by this company was closed throughout the year.

The officers of the company are: R. J. Mercur, president; S. F. Belknap, managing director.

R. H. Watson resigned as works manager in May, 1914, and was succeeded by E. J. Edwards.

When in operation about 50 men are employed.

Long Lake Zinc Mine

This property was formerly known as the Richardson or Olden zinc mine, and has been lying idle since 1912. In November, 1914, it was taken over by the Long Lake Zinc Company, and from that time until the time of writing (March 1, 1915), development work has been carried on for the purpose of determining the character and extent

of the ore body. If the results of the work prove satisfactory and a sufficient tonnage of ore is developed, it is the intention of the company to instal complete mining and concentrating equipment and to place the property on a producing basis.

The various shafts and open cuts have been unwatered, and a small amount of drifting and cross-cutting has been done. The ground between these old workings is to be proven by means of diamond-drilling, which is to begin about the first of March.

The ore body is a variety of contact metamorphic type and is located in a long, narrow band of crystalline limestone. The ore is zincblende, with small amounts of iron pyrites and galena.

C. R. Kuster is superintendent. During the winter about 20 men were employed.

Marble

Ontario Marble Qurrry

The Ontario Marble Quarries, Limited, operated its quarry near Bancroft, Hastings county, at intervals during the year.

High-grade marble is produced, varying in colour from pure white to shades of pink and green. Large blocks are cut by channelling machines, hoisted by derrick to tram cars and run direct to the gang saws. Several large columns were shipped to Vancouver for use in a large public building there.

Thomas Morrison is in charge of the quarry, employing 50 men.

Canada White Marble Company

In the township of Horton, near Haley station, Renfrew county, the Canada White Marble Company has purchased the quarry and sawing plant formerly owned by the Renfrew White Granite Company. The company has at present eight acres of surface rights, and this area appears to be nearly all white marble.

The plant includes: One stiff-leg derrick, one Sullivan channeller, one 12-h.p. upright boiler, two 100-h.p. each horizontal tubular boilers, one Bury engine, seven motor sets, three sets of gang saws, two diamond saws, one rubbing bed, one planer, one polisher, one diamond band saw, one 600-foot compressor for automatic tools.

The marble is pure white in colour and differs from other Ontario deposits in that it is easily cut to any design or pattern on account of its low degree of hardness.

Mr. Wm. Davey is manager of the company, employing 20 men.

Quarries

Britnell and Company

During the summer months this company operated their quarry at Burnt River in Victoria county on lots A and B, in the sixth concession of the township of Somerville.

The crushing plant includes one No. 5 Gates crusher, one 35-h.p. locomotive boiler, revolving screens and elevators. A siding from the Haliburton-Lindsay branch of the Grand Trunk railway runs to the storage bins.

Superintendent Weaver was succeeded during the year by J. A. Lumby.

All sizes of crushed stone are produced, also rubble, dimension, and red and blue limestone for building purposes.

Canada Cement Company

The Point Anne quarry and plant owned by the above company is situated about six miles east of Belleville, in Hastings county. All rail shipments are made by Grand Trunk and Canadian Northern railways, the main line of the latter running a short distance north of the plant. On the Bay of Quinte the company has excellent docking facilities, and owns a small fleet of canal-size boats, which handle their western shipments via Fort William.

The company shared in the general trade depression of the year, and as a result the quarry and plant were closed November 1st, remaining closed till present heavy stocks are sold.

H. L. Shock is manager, employing 35 men in the quarry.

Point Anne

Point Anne Quarries, Limited, operated their quarry during the navigation season. It is situated about one-half mile west of the Canada Cement Company plant, and also has good docking facilities on the Bay of Quinte and connection with the Canadian Northern railway for all-rail shipments.

The company ship crushed stone, rubble and crib filling.

The officers of the company are: M. J. Haney, president; J. H. M. Stewart, manager; A. G. Bennett, superintendent.

Forty men are employed.

Ontario Rock Company

At Massassauga point, in Prince Edward county, directly across the Bay of Quinte from Point Anne, the above company opened up a limestone quarry during the summer of 1914. Here the Trenton limestone outcrops over a large area, and massive beds of good quality stone are found.

The plant consists of two upright boilers, one stiff-leg derrick with 60-foot boom, one double drum Marsh and Henthorn hoist, three Holman steam drills.

On the date of inspection the quarry had been opened only a short time, but good progress was being made, and several thousand tons of rock had been shipped in scows to Toronto for use by the Toronto Harbor Commission.

Alex. Longwell is president of the company, and George Rayner, general manager. Fifty men were employed during navigation season.

Preneveau

The Ontario Rock Company operated its trap rock quarry at Preneveau, near Havelock, in Belmont township, during 1914, but with decreased production, due to slackness of demand. The plant was enlarged and greater crushing facilities provided.

George Rayner was in charge, employing 40 men.

Canada Lime Company

This company operated its quarry at Coboconk village in Haliburton county continuously throughout the year. A high-grade white lime is produced, for which a ready market is secured. Three kilns, producing about 30 tons per day, are operated when demand is good, and during slack periods one kiln, producing about two cars of lime per week, is sufficient to supply the trade.

Wood, which is still plentiful in the vicinity of Coboconk, is used for fuel. In the quarry are two upright boilers of 15-h.p. each, one stiff-leg derrick, one double-drum Beatty hoist.

C. R. Christie is president of the company, and James Ballantyne superintendent, employing 15 men.

Crushed Stone, Limited

This company was formed about ten years ago, and a lease obtained from the Dominion Government on the rock dump along the banks of the Trent Valley canal. The crushing plant is situated on lot 49, Eldon township, Victoria county, near the village of Kirkfield. This lease will shortly expire, and it is the intention of the company to open up a quarry on the above lot, and continue in business. The plant includes one No. 7½ McCully crusher, one No. 4 Gates crusher, two 100-h.p. Goldie-McCullough boilers, two revolving screens 40 feet by 12 feet.

Crushed stone in sizes from ⅜ inch to 4 inches is shipped, also dried fines for use in manufacture of asphalt.

W. H. Essery is president of the company, and A. E. Oliphant superintendent, employing 30 men.

Toronto Brick Company

This company, with head office at 64 Wellington street, Toronto, operates a limestone quarry at Coboconk, in Victoria county, for manufacturing lime. The stone is burned in three kilns having a capacity of 50 tons of lime each per week.

The plant in the quarry consists of one 20-h.p. upright Beatty boiler and hoist, two stiff-leg derricks with 60-foot booms, one Belleville steam drill.

Charles Callan is superintendent, employing 15 men.

Kirkfield Portland Cement Company

The plant of this company is located near the village of Victoria Road on lots 2 and 3 in the second and third concessions of Bexley township. Marl is dredged from Raven lake near the plant, loaded in four-yard steel dump cars, and hauled to the plant by an 18-ton locomotive. Clay is brought from Somerville township, near Fells station, via Grand Trunk railway.

At the time of inspection it was the intention of the company to open up a limestone quarry near the works, and discontinue the use of marl as a raw material.

The officers of the company are: Dr. Jamieson, president; R. G. O. Thomson, secretary; S. R. Frost, superintendent.

Crookston

On lot 10, in the ninth concession of Huntingdon township, near Crookston station, on the Belleville-Madoc branch of the Grand Trunk railway, Messrs. Quinlan and Robertson operated their crushing plant throughout the year. This is one of the oldest limestone quarries in the Province, and years of operation for dimension stone left on the ground large quantities of waste material, unsuitable for building stone. This has been used up during the year, and it is the intention to resume quarrying and continue in the crushed stone business.

The plant consists of one No. 5 McCully crusher and one No. 4 Gates.

W. E. Tummon is in charge of the work, employing 15 men.

Kingston Quarry

The Montreal Street quarry, owned by the city of Kingston, was operated during the summer months by Mr. Henry MacRow. The crushed stone was supplied to the city for street purposes.

At Portsmouth the penitentiary officials operate a small quarry, producing building stone for use in the repairing and erection of buildings and walls about the prison.

Delta Lime Company

This company is one of the oldest producers of lime in eastern Ontario. The quarry is situated on lot 27 in the eighth concession of Bastard township, and the product, a high-grade crystalline limestone, is hauled to Delta village. One kiln with a capacity of 150 bushels of lime per day is operated during the summer months.

Omar Brown is manager of the company.

Street and O'Brien

On lot 7, in second concession of Leeds township in the county of Leeds, the above firm was engaged during the year in quarrying grey granite for the manufacture of paving setts.

The quarry is located near Gananoque station on the main line of the Grand Trunk railway. Fifteen men were employed on the date of inspection, all work being done

by contract, the men receiving on the average about $28 per thousand setts. The material is of the highest grade, and as the granite lies in massive beds for several miles east and west of Gananoque, it is highly probable that this will become an important industry, when business conditions return to their normal level.

David Gordon and Sons

About 12 miles east of Gananoque, near the village of Escott in the county of Leeds, the above old-established firm operated a granite quarry for making paving setts.

The granite is similar in colour and quality to that found in Messrs. Street and O'Brien's quarry, and work is carried on in the same manner. All the workmen are experienced stonecutters, and work at a price per thousand setts. This quarry closed down on October 1st.

Renfrew Quarry

The crystalline limestones in the vicinity of Renfrew have been worked for many years as the chief source of stone supply for the manufacture of lime in eastern Ontario. The Jamieson Lime Company operate three quarries, one inside the town limits of Renfrew, and two in the second concession of the township of Horton, about two miles south of the town. When the demand is normal the company keeps three kilns burning, with a capacity of 10 tons each per day. On the date of inspection one quarry in Horton township was working. The plant consisted of one portable locomotive 15-h.p. boiler, two Ingersoll-Rand 3¼ drills and two plugger drills. The material was hauled in wagons to the kilns in Pembroke.

J. A. Jamieson is general manager of the company.

Markus Quarry

In the township of Pembroke, about two miles east of the town of Pembroke, William Markus, Limited, operates a limestone quarry. Rubble stone for pier filling, and crushed and building stone for the local trade, are shipped. Most of the stone can be quarried from the bank with bars, but where necessary in the bottom bed, two-foot holes are drilled by hand and blasted with black powder.

In the quarry the plant consists of a portable 10-h.p. boiler and Climax road-crushing machine.

William Markus is president and general manager.

Kehoe Brothers

Adjoining the Markus quarry on the north, Messrs. Kehoe Bros., of Pembroke, have secured a tract of land, and have done considerable stripping during the summer of 1914. The limestone is of the same quality as in the Markus quarry, and during the coming year it is probable that a plant will be installed and work begun in the quarry. The stone in this locality is of excellent quality for building purposes. One public building in the town of Pembroke built of limestone taken from what is now known as the Markus quarry, and erected over sixty years ago, shows no sign of deterioration.

Rideau Canal Supply Company

In the township of Nepean, just outside the city limits of Ottawa, the above company operates one of the largest limestone quarries in the Ottawa district. The working face has an average depth of 25 feet. The business of the company is chiefly in crushed stone of all sizes, but a large amount of building stone is supplied to the local trade.

The plant consists of one Marathon jaw crusher, capacity 400 tons per day, revolving screens, elevator and large storage bins.

The crushed material is graded to five sizes, large stocks of each being kept on hand for rush delivery.

Drilling is done with three Ingersoll-Rand drills, steam driven, supplied by 2 upright boilers, 15-h.p. each.

The crushing plant is run by a 75-h.p. motor, using city power.

R. Foster is manager of the company, and Charles Henry superintendent, employing 35 men in the quarry proper and 40 teamsters.

Eganville Quarry

On lot 19, in the twentieth concession of the township of Grattan, about one mile east of the village of Eganville, the Standard Chemical, Iron and Lumber Company operated its limestone quarry for eight months during the year 1914. White lime only is shipped, and due to slack trade the plant was closed from June till November.

Since last report a double drum Beatty hoist with 35-h.p boiler and a No. 11 Westinghouse air compressor have been added to the plant.

A. B. Arveson is manager, and on the date of last inspection, in December, was working with a reduced force of 10 men.

Robillard's Quarry

On lots 22 and 23, in the first concession of the township of Gloucester, H. Robilliard and Son operated their limestone quarry continuously throughout the year. White lime is burned in two kilns having a combined capacity of 700 bushels per day. The chief business in 1914 was in dimension and dressed stone for the Ottawa trade.

The plant consists of one 15-h.p. upright boiler, 2 steam drills and 4 stiff-leg derricks. The quarry has an average working face of 20 feet, and a large acreage has been worked out. This quarry is one of the oldest in Ontario, and has the distinction of having been in active operation for sixty years without a single fatal accident.

R. E. Robillard is general manager of the company, employing on the date of inspection 10 men.

Gosselin Quarry

A short distance east of Robillard's quarry, on lot 22 in the township of Gloucester, Mr. Charles Gosselin continued to operate his limestone quarry with a reduced force of 13 men.

The plant consists of one upright 12-h.p. boiler, one Climax jaw crusher, one Case steam thresher engine 25-h.p., one stiff-leg derrick.

Rubble, crushed, dressed and dimension stone are supplied to the trade in Ottawa.

A short distance west of Robillard's quarry, on the Montreal road, in Gloucester township, the following operators are engaged in quarrying limestone on properties held under lease from the owners. Work is carried on in a small way, no plant being required:—

Messrs. Larocque and Jamieson employ 8 men.

Mr. Fred. Holliday employs two men.

Mr. James Fox employs two men.

THE BEATTY-MUNRO GOLD AREA

By P. E. Hopkins

Introduction

The Beatty-Munro gold area is situated in the Larder Lake Mining division, District of Timiskaming, Ontario, at about latitude 48° 30′ north and longitude 80° 15′ west. The Timiskaming and Northern Ontario railway shown on the southwestern portion of the map passes through Matheson, a thriving town in the centre of a farming community. Good wagon roads run nine miles northeastward to the mining locations around Painkiller lake, and eastward to Munro township.

Looking north across Painkiller Lake from Cartwright property

Claims were staked for gold in Beatty and Munro townships in 1908 shortly after the gold rushes into Larder lake, Lake Abitibi and Night-hawk lake. The finding of large gold deposits in the Porcupine area, 45 miles to the west, in 1909 and 1910, revived the interest in this area. Considerable prospecting and development work have been done. Some gold bullion has been shipped from two or three properties.

During August, 1911, Mr. A. G. Burrows and party examined and mapped Munro and a portion of Guibord townships.[1] During June, 1914, the writer, assisted by Mr. C. W. Greenland, continued the geological mapping westward into Beatty and northward into parts of Warden and Coulson townships. The two maps, embracing about 150 square miles, have been incorporated and published as a coloured geological map[2] on a scale of one mile to the inch to accompany this report.

The rocks are all pre-Cambrian in age, and no younger rocks are known to occur within 75 miles. They consist of Keewatin greenstones, Timiskaming sediments and later diabase and porphyry intrusions.

[1]Map No. 21c, Ont. Bureau of Mines.
[2]Map No. 24a, Ont. Bureau of Mines.

The gold veins are small and belong to the pyritic-gold-quartz type, with transitions to the arsenical type. The study of the veins in the vicinity of Painkiller lake, Beatty township, shows the presence of considerable tellurides associated with the gold. These veins resemble the small gold telluride veins of Kirkland lake.

Topography

The area is from 850 to 1,400 feet above sea level. The station at Matheson has an elevation of 873 feet. The southwestern portion of the area around Matheson is undulating land of a good quality of grey stratified clay and clay loam, which has been taken up as farming lands. The larger northeastern portion shown on the map is very rocky, and contains many rounded hills 300 to 350 feet above the surrounding valleys. Between the hills are swamps or rolling sand and boulder plains and ridges. From the top of the high hill in lot 12, Con. VI, Munro, the basin of Lake Abitibi can be seen to the northeast. More than one-half of the rocky portion is staked as mining claims.

Nearly all the forest area has been burned and re-burned in recent years until little valuable timber remains. However, in places there are good spruce, poplar, balsam and white birch, some of the trees being as much as 30 inches in diameter.

The country is drained by the Black river and its tributaries, which flow northward, finally emptying into James bay.

Since the building of the dam at Iroquois Falls the Black river has been raised until the McDougall chutes at Matheson have disappeared. There now remain no water-powers of any consequence in the area embraced by the map.

Moose, deer, bear, rabbits, grouse and fish are plentiful, and constitute the principal game. Brook trout are numerous in many of the creeks.

The magnetic declination is fairly constant, the average being 10° west.

Geology of the Area

The rocks of the area may be classified as follows:—

Pleistocene	
Glacial and recent	Stratified clay and sand, boulder clay and gravel, etc.
	PRE-CAMBRIAN
Post-Timiskaming intrusives	Feldspar porphyry dikes.
(Intrusive contact)	
	Diabase dikes and boss-like masses.
(Intrusive contact)	
Timiskaming series	Slate, greywacké, quartzite, conglomerate and schistose derivatives.
Igneous	Feldspar porphyry. (Intrudes the Keewatin but relationship to the Timiskaming series is not known.)
(Intrusive contact)	
Keewatin	Amygdaloidal and ellipsoidal basalt, diabase, serpentine, iron formation and breccia with metamorphosed and schistose derivatives.

The Keewatin

The rocks of the Keewatin system are the predominant ones in the area, and important since they contain gold-bearing veins. They are usually massive, with some schist areas, but on the whole they are much less schistose and less altered than the somewhat similar rocks of the Porcupine area.

Basalts.—The greater part of the Keewatin rocks are basic volcanics of the basalt type. They consist largely of coarse, white-weathering amygdaloidal and dark fine-grained ellipsoidal basalts, often occurring in alternating bands 100 or more feet in thickness with sharp vertical contacts. The silicious and rounded amygdules, as large as one inch in diameter, are packed close together, at times presenting a conglomerate appearance. The amygdules consist of quartz, "carbonate,"[3] sericite and sometimes pyrite and feldspar. Quartz and chalcedony are frequent constituents of the amygdules. The small amount of ground mass often consists of chlorite and kaolin, with some "carbonate," magnetite and pyrrhotite. However, occasionally the ground mass is much fresher and consists of altered basic feldspar laths in hornblende, chlorite and epidote. A beautiful lava from lot 1, con. VI, Beatty township, consists of 75 per cent. of fresh labradorite laths, showing albite-lamellation, with a few isolated rounded and hexagonal grains of cordierite in a ground mass of chlorite, "carbonate," epidote, magnetite, pyrite and iron oxide.

Vertical face of pillow lava, north part of lot 11, concession VI., township of Beatty

The following analyses were made by Mr. W. K. McNeill:—

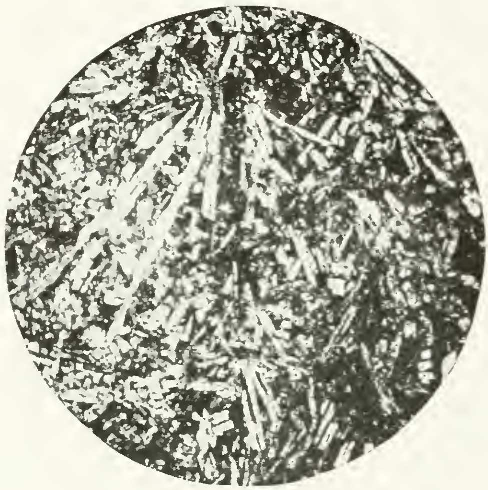
	(1) Per cent.	(2) Per cent.
Silica	56.40	51.80
Alumina	22.98	17.25
Ferrous oxide	6.45	9.66
Ferric oxide	trace	3.11
Lime	7.16	4.01
Magnesia	trace	2.68
Soda	1.59	3.88
Potash	0.46	0.58
Carbon dioxide	1.29	3.08
Water	3.53	4.16
	99.86	100.21

[3]The carbonate referred to throughout the report is calcite or dolomite.

No. 1, Ellipsoidal basalt from lot 1, concession VI, Beatty township. The high percentage of silica is due to the cordierite.

No. 2, Ellipsoidal basalt from the north half of lot 2, concession II, Beatty township.

A thin section of an ellipsoidal basalt from the north half of lot 2, concession II, Beatty township, the analysis of which has been given, shows numerous small rods



Photomicrograph of ellipsoidal basalt, from lot 1, con. VI., Beatty township. X 20 diameters

Photomicrograph of andalusite schist, showing crystals of chrastolite set in a groundmass of radiating sillimanite, from lot 5, concession V., Beatty township. X 40 diameters

of anorthite partly replaced by sericite, and a few very small grains of quartz in a ground mass of hornblende, largely gone to chlorite, with some "carbonate," sericite, kaolin, epidote, pyrite and magnetite. Some of the feldspar may be recrystallized.

Diabase and other Altered Rocks.—Old diabase, which occurs in small volume, intrudes the ellipsoidal and amygdaloidal basalts. The rock is old in appearance and greatly altered, and probably belongs to the Keewatin complex. Some diabase can be

seen in nearly any of the large Keewatin exposures. In lot 8, concession 1, Coulson township, a fresh diabase dike intrudes this old diabase. A thin section of the later rock shows basic feldspar laths, largely gone to saussurite, together with augite and hornblende, much chlorite and magnetite and a little epidote and pyrite.

Some dark green, medium-grained rocks are so altered that there is no clue whatever as to their original nature. A thin section of such a rock from the northwest corner of lot 5, concession VI, Beatty township, consists of more than one-half hornblende, with a little augite, feldspar laths altered to sericite, chlorite and much "carbonate" and kaolin. A little pyrrhotite, magnetite and iron oxide are present. The rock may be an altered diabase.

Serpentine, containing veinlets of magnetite, lot 10, concession 1, township of Warden

In the vicinity of lot 12, concessions I and II, Coulson township, augite phenocrysts are prominent in the greenstone.

A green metamorphosed rock, rich in andalusite, occurs in contact with quartz diabase about the centre of lot 5, concession V, Beatty township. A thin section shows numerous large prisms and almost square crystals of chiastolite with "carbonate" and chlorite inclusions embedded in a radiating sillimanite aggregate with cross fractures through which are small amounts of "carbonate," chlorite, epidote, pyrite and magnetite.

Agglomerate and *Breccia*.—Circular areas of agglomerate 50 feet or more in diameter, occur throughout the Keewatin areas. These may be old volcanic necks.

The Keewatin rocks also are brecciated in places. In the vicinity of lot 9, concession VI, Beatty township, the pillow lavas have picked up dark, silicious, angular, igneous fragments which are 4 or 5 inches across.

Serpentine.—In many places the greenstones are much altered to serpentine. They are found in many parts of Munro township and in northeast Beatty, most of the outcrops being marked on the map. In lot 10, concession II, Munro, the serpentine contains numerous veinlets of fibrous asbestos and a little magnetite, some of the veinlets being over one-half an inch in width. This area might be worthy of investigating as a source of asbestos. In lot 10, concession I, Warden township, the white-weathering serpentine contains a network of numerous veinlets of magnetite which withstand the weathering and project above the serpentine. Specimens from this locality were analyzed and found to contain no platinum or chromium.

Iron Formation.—Iron formation, consisting of narrow, alternating bands of sugary quartz and magnetite and dipping vertically, is enfolded in the greenstones. Exposures can be seen in lot 10, concession II, and other parts of Munro township.

Lamprophyre is rare in this area. A mica lamprophyre dike was seen in lot 2, concession II, Beatty township. It is similar to the lamprophyre which occurs in great volume cutting the sediments of the Timiskaming series at Kirkland lake.

Feldspar Porphyry

On the map will be seen a large porphyritic granite or rhyolite exposure, one-quarter of a mile or more in width and extending for three miles across concession III of Beatty township. The same rock extends eastward into the centre of Munro township, where it has not been separated from the Keewatin complex. It clearly intrudes the Keewatin basalts, and is cut by a diabase dike on lot 6, concession III, Beatty, but its relationship to the Timiskaming series is not known. The rock has prominent quartz and feldspar phenocrysts, is light grey in colour, and weathers white. Traversing it in places are numerous quartz stringers carrying pyrite. The dike was reported to carry low values in gold where it crosses the boundary line between Munro and Beatty townships. In lot 6, concession III, Beatty, the rock takes on a beautiful flow structure. Under the microscope the spherulitic structure is commonly seen.

The phenocrysts consist of numerous radiating feldspar structures, known as spherulites, one-eighth of an inch across, and albite, partly altered to sericite, with considerable irregular coarse quartz grains in a ground mass of quartz, sericite, " carbonate," chlorite and epidote.

A sample from lot 10, concession II, Munro, gave on analysis the following:—

	Per cent.
Silica	78.70
Alumina	6.56
Ferrous oxide	0.90
Ferric oxide	2.51
Lime	2.11
Magnesia	0.28
Soda	1.58
Potash	6.42
Carbon dioxide	0.42
Water	0.65
	100.13

The Timiskaming Series

A band of rocks of the Timiskaming series runs northwestward for nine miles from northwest Guibord to lot 13, concession IV, Beatty. The rocks are similar to those at Porcupine and Kirkland lake, and also contain gold-bearing veins. In fact this band may be continuous with the Timiskaming series of Porcupine. The rocks

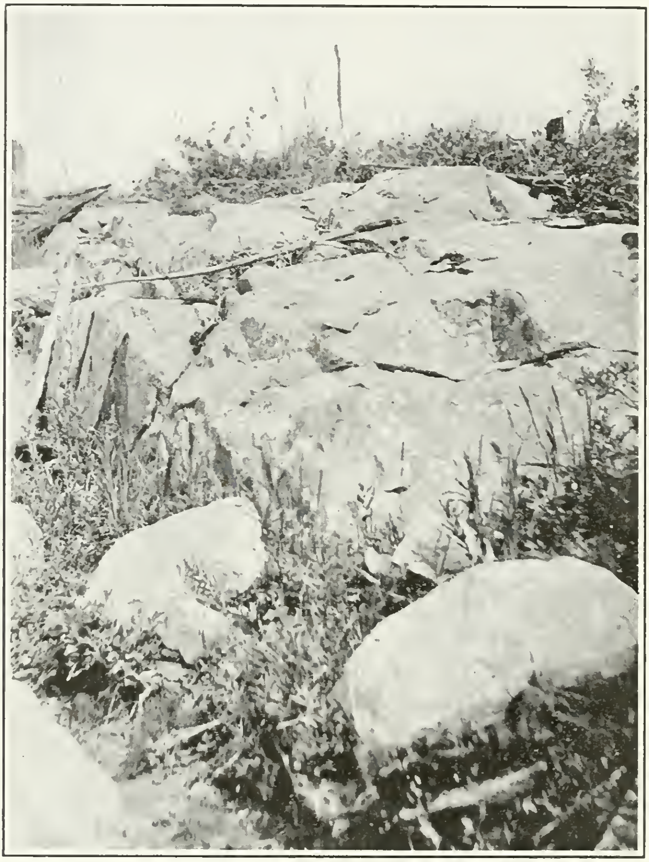
weather easily, and therefore have low exposures. A good contact was not seen between the Timiskaming and the Keewatin, but the former appears to be enfolded and to lie unconformably on the Keewatin. The Timiskaming rocks consist of greywacké, slate, quartzite and a little conglomerate, all of which have been altered to schists. They strike nearly east and west and dip at high angles, many strikes and dips being shown on the map. The only two conglomerate bands seen were on the Detroit New Ontario property and on lot 1, concession II, Beatty township, near the base of the series in both cases. The pebbles consist of quartz porphyry and greenstones, somewhat drawn out. Mr. Burrows mentions a porphyry dike three feet wide that cuts across the greywacké schist on the Detroit New Ontario property. Many diabase dikes intrude the Timiskaming series in various localities.

Feldspar porphyry, showing feldspar phenocrysts and flow structure, lot 5, concession III., township of Beatty

The Post-Timiskaming Intrusives

Quartz Diabase.—The quartz diabase which intrudes the rocks of the Timiskaming series in many places occurs as dikes and boss-like masses. The dikes, which appear to be more silicious than the broader boss-like masses, may have been the feeders to these larger diabase bodies, some of which are partly eroded away. Throughout these large diabase areas in north Munro are roof pendants or erosion remnants of iron formation, serpentine and other Keewatin rocks. The large outcrops often become as coarse as gabbro, but they still retain their ophitic texture. In parts of Beatty township the diabase contains much magnetite which often on weathered surfaces occurs in dendritic forms.

These rocks are probably of the same age as the large masses of diabase around Abitibi lake, which Mr. M. B. Baker says are in every way like those of the Cobalt area.[4] In the field the diabase in parts of Munro township has a slightly older look than the Nipissing diabase from the sill at Cobalt. However, under the microscope the two rocks are identical. A thin section of a quartz diabase from lot 6, concession 1, Beatty, which is typical of most sections examined, consists of labradorite laths showing albite twinning lamellae partly altered to saussurite and sericite, augite partly gone to hornblende, and chlorite with a little quartz, biotite, apatite and magnetite. Most thin sections, especially those from the dike rocks, show beautiful intergrowths of



Diabase, lot 9, concession I., township of Munro

quartz and feldspar. Others show leucoxene, epidote and other secondary minerals. Samples of diabase from lot 4, concession VI, and lot 9, concession I, Beatty, gave on analysis 52.7 and 50.7 per cent. of silica respectively. It appears that this diabase, which is similar to the diabase at Kamiskotia lake, Robb township, is older than the Nipissing diabase. No silver appears to have accompanied the intrusion. The metal was found to be absent in a sample of calcite and quartz from a large lense on lot 8, concession VI, Munro.

Feldspar porphyry.—The feldspar porphyry, which is grey and reddish in colour, occurs as dikes from a few feet up to 50 feet or more in width. These dikes generally occur in the diabase or near diabase outcrops. Many of them are too small to map.

[4] Ont. Bureau of Mines, Vol. XVIII, p. 280, and accompanying map.

The small, grey feldspar porphyry dike cutting the greywacké schist of the Timiskaming series on the Detroit New Ontario property was examined under the microscope. It consists of numerous phenocrysts of albite partly altered to sericite, and some smaller grains of quartz in a ground mass of quartz, feldspar, sericite, carbonate, leucoxene, magnetite and pyrite.

In lot 9, concession V, Beatty, is a reddish feldspar porphyry dike which resembles the feldspar porphyry dikes of Kirkland lake megascopically, microscopically and chemically.[5] A thin section shows 75 per cent. of feldspar, the phenocrysts being largely albite, some microcline and a little orthoclase partly gone to sericite, a few quartz grains, some biotite partly altered to chlorite. The ground mass is microcrystalline in texture, and consists of feldspar, quartz, chlorite, "carbonate" and sericite. Some magnetite or ilmenite is present, and the feldspars occasionally have a zonal structure.

A specimen of the porphyry was found, on analysis, to have the following composition:—

Photomicrograph of feldspar porphyry, from lot 9, concession VI, Beatty township. X 20 diameters

	Per cent.
Silica	65.46
Alumina	16.88
Ferrous oxide	1.92
Ferric oxide	2.04
Lime	2.06
Magnesia	0.93
Soda	4.42
Potash	4.35
Sulphur	....
Carbon dioxide	0.98
Water	1.09
	100.13

A thin section of a porphyry dike cutting the diabase on lot 7, concession VI, Beatty township, was examined. Over one-half the section consists of phenocrysts of albite, and there is a little microcline and some orthoclase largely altered to sericite, much biotite partly altered to chlorite and a little quartz in a microcrystalline ground mass of feldspar, quartz, "carbonate," apatite and pyrite. This later porphyry is regarded as an acid phase of the diabase.

[5]Ont. Bureau of Mines, Vol. XXIII, pp. 11, 15.

Economic Geology

Character of Gold Veins

The gold-bearing quartz veins occur in rocks of Keewatin and Timiskaming age. The veins to which attention has chiefly been directed lie in the southwest part of Munro township and adjacent area, and in the vicinity of Painkiller lake. The veins are often quite regular and traceable over several hundred feet. In Munro they generally strike nearly east and west and dip at high angles to the south, while at Painkiller lake some strike northeastward. In general the veins are of small size, rarely more than a foot in width. In places, however, there is an aggregate of tiny stringers through which gold-bearing solutions have passed. Occasionally a vein may be several feet in width.

The quartz is very much fractured, and consists of several generations. Visible gold occurs in the fractures in a number of veins. A spectacular discovery was recently made on the Dobie-Leyson claim, lot 10, concession 1, Munro township, where one specimen of gold was the size of a hen's egg. Tellurides in a state of fine division were detected in the gold-bearing veins near Painkiller lake. No tellurides, however, were found in the vicinity of southwest Munro. Associated with the gold minerals are varying quantities of iron pyrites, chalcopyrite, pyrrhotite, galena and mispickel. The gangue is largely quartz, fractured and refractured, with some " carbonate," sericite and chlorite. Tourmaline was noticed in one vein. Arsenical pyrites occurs in quantity in veins on the Treadwell property, lot 9, concession VI, Beatty, and on the Dunlap, lot 8, concession V, Beatty. The Dobie-Leyson vein, lot 10, concession I, Munro, also contains fine crystals of mispickel. Molybdenite was noticed on the Abate claim, lot 4, concession I, Beatty. Fluorite, which is the chief gangue mineral at Cripple Creek, Col., was not noticed in the veins of the area. However, in August, 1914, the writer noticed several fluorite and barite veins in Cairo township, about 25 miles southwest of Kirkland lake.

Tellurides at Painkiller Lake

Tellurides were recognized in several small gold-bearing quartz veins in the vicinity of Painkiller lake, on lots 8 and 9, concession V, Beatty township, and on lots 6, 7 and 9, concession VI, of the same township. No doubt they occur and will be found elsewhere in the vicinity. The best telluride specimens were obtained from No. 2 vein on the Treadwell property, lot 9, concession VI, Beatty township.

Owing to the tellurides being in very fine grains and in close association with the gold, it is difficult to identify them. These minerals occur in fractures in the quartz with grains and seams of gold through them. Certain polished surfaces of the tellurides were examined under a microscope with reflected light, special attention being paid to the slight variation in colour and the effect after adding a drop of nitric acid. Most of the tellurides have a creamy-white colour and after the addition of a drop of HNO_3, turn brown and effervesce strongly, leaving a characteristic etching resembling that of calaverite. There are small amounts of another telluride, light grey in colour, which were found to contain bismuth.

Genesis of the Mineral Deposits

The gold quartz veins of Beatty and Munro townships occur chiefly in narrow fissures which have been enlarged by replacement of the country rock. Pyrrhotite, tourmaline and other minerals suggest that the veins were formed at a high temperature and pressure and at a great depth. Magmatic waters connected with the grey and red feldspar porphyry dikes, the latest intrusions in the area, and probably acid phases of the diabase magma may have had a good deal to do with the ore formation.

Other Minerals

Nickel occurs in a 5-foot pyrrhotite vein on the boundary line between Beatty and Munro townships in concession III. The pyrrhotite sample gave nickel 1 per cent., gold none, platinum none.

In lot 5, concession VI, Beatty, is a rusty band 3 feet wide, rich in pyrrhotite, running northwest and southwest. A grab sample gave 40 cents in gold and a trace of nickel.

Numerous veinlets of fibrous asbestos up to one-half an inch in width occur in the serpentine on lot 10, concession II, Munro township. This area might be worthy of investigating as a source of asbestos.

Mining Locations

The important mining locations are situated in or near the southwest corner of Munro township and in the vicinity of Painkiller lake. The properties in Munro are in much the same condition as they were in August, 1911, when Mr. A. G. Burrows visited the area. The descriptions of the following three properties are from Mr. Burrows' notes:

Munro Mines

The Munro mines, locally known as the Guelph, in the southeast corner of lot 11, concession I, Munro township, are entirely in the slates of the Timiskaming series. The first operations in the area were at this property, where a shaft was sunk 92 feet on an east and west quartz vein carrying pyrite, and some drifting done on the 60-foot level. No work has been done since 1910.

Detroit New Ontario

The greatest development has taken place at the Detroit New Ontario property, where a 9 by 7 shaft has been sunk 100 feet, and 200 feet of drifting and cross-cutting on three narrow quartz veins accomplished. The main vein strikes east and west and dips 80° to the south, and can be traced westerly intermittently 1,300 feet to the Guelph shaft. The vein is regular in width, and contains pyrite and visible gold in places. A small prospecting stamp mill was in operation in August, 1911, and some bullion has been produced. The property has been closed since the end of 1911. A 250-h.p. boiler and a six-drill compressor are on the property.

Gold Pyramid

At the Gold Pyramid mine, in Guibord township, there are two prominent quartz veins. On the southern of these the development work consisted of a shallow shaft and open cut, with some trenching in deep soil to the south. The vein, which dips to the south, has been exposed for about 250 feet. The northern vein has been traced for 400 feet, and a shaft was being sunk on it (August, 1911). Pyrite and fine galena are plentiful, with visible gold in places. A 5-stamp mill erected in 1911 has treated considerable ore. Some bullion has been shipped.

American Eagle

On the American Eagle a shaft has been sunk about 75 feet and some drifting and cross-cutting done. The plant consists of two 50-h.p. boilers, a 6-drill compressor, a hoist and a Tremaine stamp. The property has been closed since about 1912.

Dobie-Leyson

In the spring of 1914 a very interesting gold find was made by Mr. Welsh on the north of lot 10, concession I, Munro township. However, when Messrs. Dobie and Leyson had their claim, N.E. corner, N. ½ lot 10, concession 1, Beatty, surveyed, the rich vein was found to be on the latter claim, 15 feet from the Welsh line. The quartz lode is lenticular, runs north and south and dips from nearly horizontal to 45° to the

east. It occurs in amygdaloidal basalt and altered diabase of the Keewatin system. The quartz is greyish in colour and contains much pyrite, some mispickel needles and very coarse dark yellow gold. One gold nugget was egg-shape, being 2 inches long and 1¼ inches across. The vein is cut off to the south by an east-west fault, the south portion of the vein probably being the Welsh vein, which is 200 feet west. Some drag vein matter, rich in gold, occurs in the fault zone about 40 feet west of the Dobie-Leyson vein. No work other than some stripping and the sinking of a shallow test pit had been done up to June, 1914. The property is now under option by the Dominion Reduction Co., Ltd., of Cobalt. This company commenced mining operations in July, 1915.

Abate

Gold was found on lot 4, concession 1, Beatty, on Abate's claim. The quartz vein and greywacké schist both strike 5° north of east and dip 80° to the north. Some quartz stringers cut across the schist. Much pyrite and considerable molybdenite and some fine visible gold were seen in the rusty quartz vein. Some test pits were sunk and trenching done by the Hudson Bay Mining Company, who had the property under option.

Treadwell

The claim known as the Treadwell or Mayot is situated in the southeast corner of lot 9, concession VI, Beatty township. The veins occur in amygdaloidal and ellipsoidal basalt and diabase of the Keewatin system. The southern or No. 1 vein, which is about 4 feet wide at the shaft, runs east and west magnetic. It is very rusty and contains considerable pyrite and mispickel. One piece containing much mispickel gave $3.60 in gold. A shaft has been sunk 32 feet on this vein. No. 2 vein commences about 100 feet north of the 32-foot shaft and runs northeast for 350 feet, and has a 20-foot pit on the northeast end of it. The quartz vein is from 3 inches to one-half an inch in width with an occasional branching stringer. The vein contains much visible gold, tellurides, pyrite and pyrrhotite, and resembles the No. 2 vein of the Tough-Oakes mine, Kirkland lake. The best telluride samples were obtained from this vein. One hundred feet south is a parallel vein from 3 to 12 inches wide. A channeled sample across 11 inches on this vein gave $2.80 in gold.

Cartwright

The Cartwright Gold Fields, Limited, have their main workings on the south shore of Painkiller lake on lot 8, concession V, Beatty. The small quartz vein carrying visible gold, telluride and pyrite runs northward into the lake. A shaft is down 100 feet and work is being carried on at the present time (May, 1915).

The old plant and buildings were burned in 1913.

The new plant consists of a 3-drill compressor, hoist, and two 60-h.p. boilers. All the machinery in connection with a 10-stamp mill is on the ground and being erected.

Painkiller

The Painkiller property is the northwest claim in lot 7, concession VI, Beatty township. A shaft has been sunk 94 feet on a quartz stringer carrying gold which was reported to have disappeared at about 35 feet. No work has been done for a number of years.

Mayot

On the claim immediately east of the Painkiller, tellurides were noticed in an aggregate of parallel quartz stringers.

Dunlap

On the Dunlap claim, lot 8, concession V, Beatty, is a 7-foot quartz mispickel vein, running east and west, upon which a 20-foot pit has been sunk. Samples taken gave low gold values.

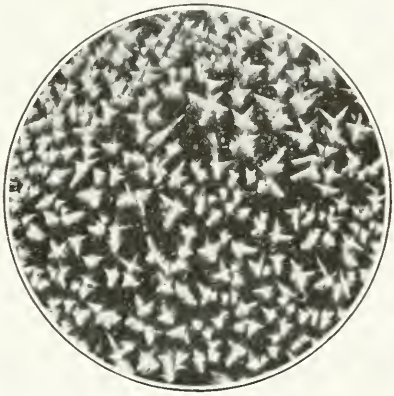
Tellurides in Other Parts of Ontario

Knowledge of the occurrence of different tellurides in gold-bearing veins in Northern Ontario is gradually being extended. On account of the number of discoveries in the last few years and the fact that, heretofore, the known occurrences of tellurides have been few in number, a list of these is here given. The list adds considerably to that compiled by D. D. Cairnes in 1911.[6]

As far back as about 1880 a telluride sylvanite was recognized at the Huronian mine, Moss township, in association with argentite, galena, iron pyrites, chalcopyrite, zinc blende, fine gold and quartz.[7] In 1895 Dr. A. P. Coleman[8] reported nagyagite, telluride of lead, from the same property. He also reported hessite, telluride of silver, from Gold creek, Pine Portage bay, Lake of the Woods.

Robt. Harvie reported the telluride, petzite, in association with pyrite, chalcopyrite and visible gold in quartz-ankerite deposits at Opasatika, 40 miles easterly from Kirkland lake, in the Province of Quebec.[9]

In Porcupine only one telluride, hessite, has been recognized occurring in small amounts in the quartz carbonate deposit at the Powell claim, ME 20, in Deloro town-



Polished altaite, from Tough-Oakes mine, showing characteristic etching by a drop of nitric acid, magnification 70

ship. A. G. Burrows[10] also mentions that the presence of telluride in a quartz ore containing considerable pyrite from the Mikado mine, Lake of the Woods, has lately been recognized in the laboratory of the Provincial Assay Office. Knowing this, the writer made a further test on a Mikado telluride sample found in the Bureau of Mines' collection. The coarse telluride was polished and found to be uniform. It has a creamy colour compared with altaite, and is slightly whiter in colour than calaverite. The mineral effervesces strongly with HNO_3, and turns black. While silver was found to be absent, the mineral gave strong reactions for bismuth. It is therefore a bismuth telluride—probably tetradymite.

In the spring of 1912 tellurides were found on the Tough-Oakes gold claims at Kirkland lake. Analysis of these showed abundant altaite, telluride of lead, and some calaverite. Messrs. Campbell and Deyell, of Cobalt, report the presence of tetradymite, telluride of bismuth, and hessite, telluride of silver, in ore from No. 2 vein of the

[6] "Canadian Tellurium-containing Ores," in Jour. of Can. Min. Inst., Vol. XIV, 1911, p. 185.
[7] Mineral Resources of Ontario, 1890, p. 25; Geological Survey of Canada, new series, Vol. III, p. 13 H; Vol. IV, p. 61 T; Vol. X, p. 59 H.
[8] Ont. Bureau of Mines, Vol. V, pp. 105-6.
[9] Notes on a Discovery of a Telluride Gold Ore at Opasatica. Journal of the Can. Min. Inst., Vol. XIV, p. 164.
[10] Ont. Bureau of Mines, Vol. XXI, Pt. I, pp. 229-231.

Tough-Oakes gold mine.[11] The study of polished surfaces of the tellurides of the Tough-Oakes ore confirmed the presence of altaite and calaverite, and in addition a mineral was noticed which has a bluish white colour—probably native tellurium.

In the summer of 1914 tellurides and gold were found in narrow quartz veins on the Malouf, Smith-Labine and other claims on lots 9 and 10, concession II, Maisonville township, and lot 10, concession II of the same township.[12] A sample from the Smith-Labine claim contains two tellurides which have not yet been identified. Tellurides were also reported on the Stitt claim in central Grenfell township.

Conclusion and Acknowledgments

The Beatty-Munro gold area is one worthy of more systematic prospecting. The veins so far found are mostly small, but thorough prospecting may reveal wider and richer ones. Several samples assayed showed the gold to be widely distributed. The veins in the vicinity of southwest Munro are of the Porcupine type, while those at Painkiller lake closely resemble the gold-telluride veins at Kirkland lake. The finding of so many gold-telluride veins in the immediate vicinity, viz.: Kirkland lake, Maisonville and Grenfell townships, Opasatika lake, Painkiller lake and Deloro township, shows that the gold-telluride minerals are widely distributed, and by further searching larger and richer deposits are likely to be found.

The assays and analyses were made by Messrs. W. K. McNeill and T. E. Rothwell, of the Provincial Assay Office. Mr. C. W. Greenland, of Port Arthur, acted as assistant, and rendered efficient service. The writer is indebted to several prospectors for assistance. The photomicrographs accompanying the report were made by Mr. C. W. Knight.

[11] Ont. Bureau of Mines, Vol. XXIII, Pt. 2, p. 23.
[12] Ont. Bureau of Mines, Vol. XXIII, Pt. 2, pp. 34-35.

THE PRODUCTIVE AREA OF THE MICHIPICOTEN IRON RANGES

By

Arthur L. Parsons

Introduction

In accordance with instructions received from Mr. Thomas W. Gibson, Deputy Minister of Mines, the writer left Toronto May 22nd, 1914, to investigate the iron and other economic deposits in the Michipicoten mining division, more particularly in the vicinity of the Helen and Magpie mines. In the latter part of August an unsuccessful search was made in the vicinity of Maimanse for the old locality for pitchblende or uraninite.

In this report petrographic detail has been avoided, and in general the rock names are those that would be employed in the field.

Fig. 1—Country to east of Iron Knob, Magpie Mine, showing relief of region

In carrying out the work the writer made constant use of the maps and reports of Professors Coleman and Willmott, and of Dr. J. M. Bell, published in previous reports[1] of the Bureau of Mines, and devoted his attention more particularly to supplementing the information given by these gentlemen. In consequence a detailed description of the topography and canoe routes is omitted, as these have been described in more or less detail in the older reports. Where photographs could be secured to show particular features of topography, geology or industrial development, they are included as illustrating more clearly than in any other way the points in question. It is then left to the reader to judge the correctness of interpretations of geological phenomena where there may be cause for doubt.

The principal geological features are embodied in the maps accompanying this report, and the principal routes of travel are shown. For the productive area, the old means of travel by canoe has been superseded by the railway and a few fair wagon roads, but the region west of the Magpie mine is still accessible in summer only by canoe.

[1]Ont. Bureau of Mines, Vol. VIII, pp. 255-258; Vol. IX, pp. 154-164; Vol. XI, pp. 152-185; Vol. XIV, Pt. 1, pp. 278-355.

The important new developments in the region are the opening of the siderite deposits at the Magpie mine and the development of the pyrite deposits, which give promise of adding largely to the prosperity of the Province. At the present time it is impossible to give figures on the cost of producing roasted ore from the siderite, as the roasting plant has not been in operation long enough to estimate the annual repairs. If the costs can be kept down to a reasonable figure, the known deposits alone will provide for a large mining industry.

General Geology of the Region

Our knowledge of the geology of this region dates back to about 1846, when Sir William Logan and his assistant, Mr. Alexander Murray, examined the shores of lake Superior and explored the Michipicoten and other rivers. The most important contribution made by these gentlemen was the description of the wonderful conglomerate near the Doré river and Michipicoten harbour.

The first mention of iron ore in this region appears to have been made by Mr. Thomas MacFarlane in 1866, when he described[2] the deposits on Gros Cap peninsula and at Bachewahnung, now Batchawana.

Further work of an exploratory nature was done by Dr. Robert Bell, but the value of his work, together with that of his predecessors, is lessened by the lack of satisfactory maps.

The most important contributions to our knowledge of the region are to be found in the reports and papers of Professors Coleman and Willmott, who, together and separately, worked in this region for several seasons. In their work they have not only incorporated the valuable portions of the work of their predecessors, but have added a wealth of information derived from their own explorations, and the value of their work is enhanced by numerous excellent maps. The work of these two gentlemen is supplemented by that of Dr. J. M. Bell, who explored the western ranges, giving with his report a good map.

The geological formations that have been found in this region are:

Recent
Keweenawan
Timiskamian[3]
Laurentian
Keewatin

Keewatin

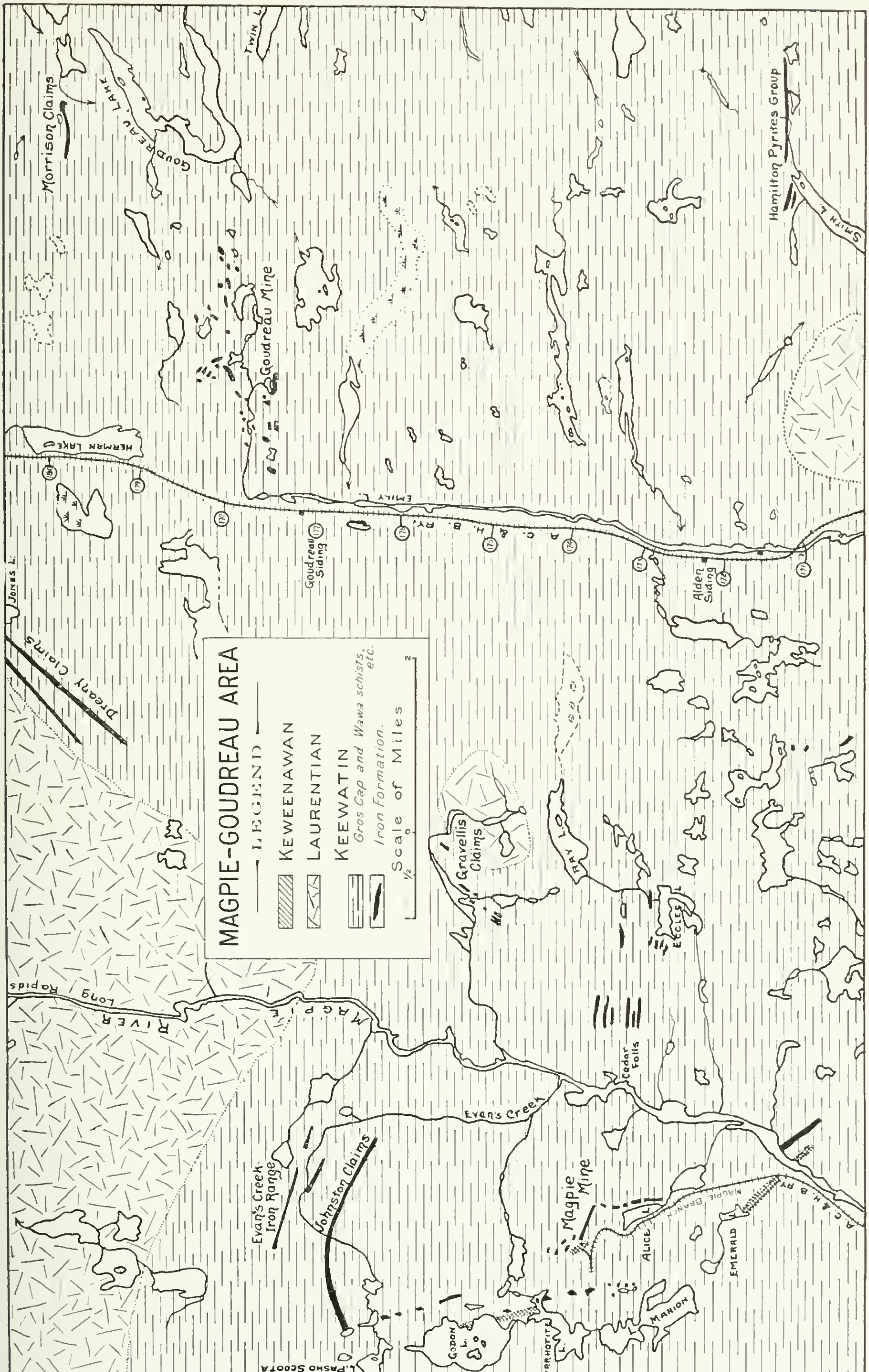
The Keewatin rocks are the most abundant of all those found in the productive area of the Michipicoten iron ranges, and in this series is the source of all the iron ore and pyrite of the region. I nearlier reports, the series has been called "Lower Huronian," while the Doré conglomerate was referred to as the "Upper Huronian."

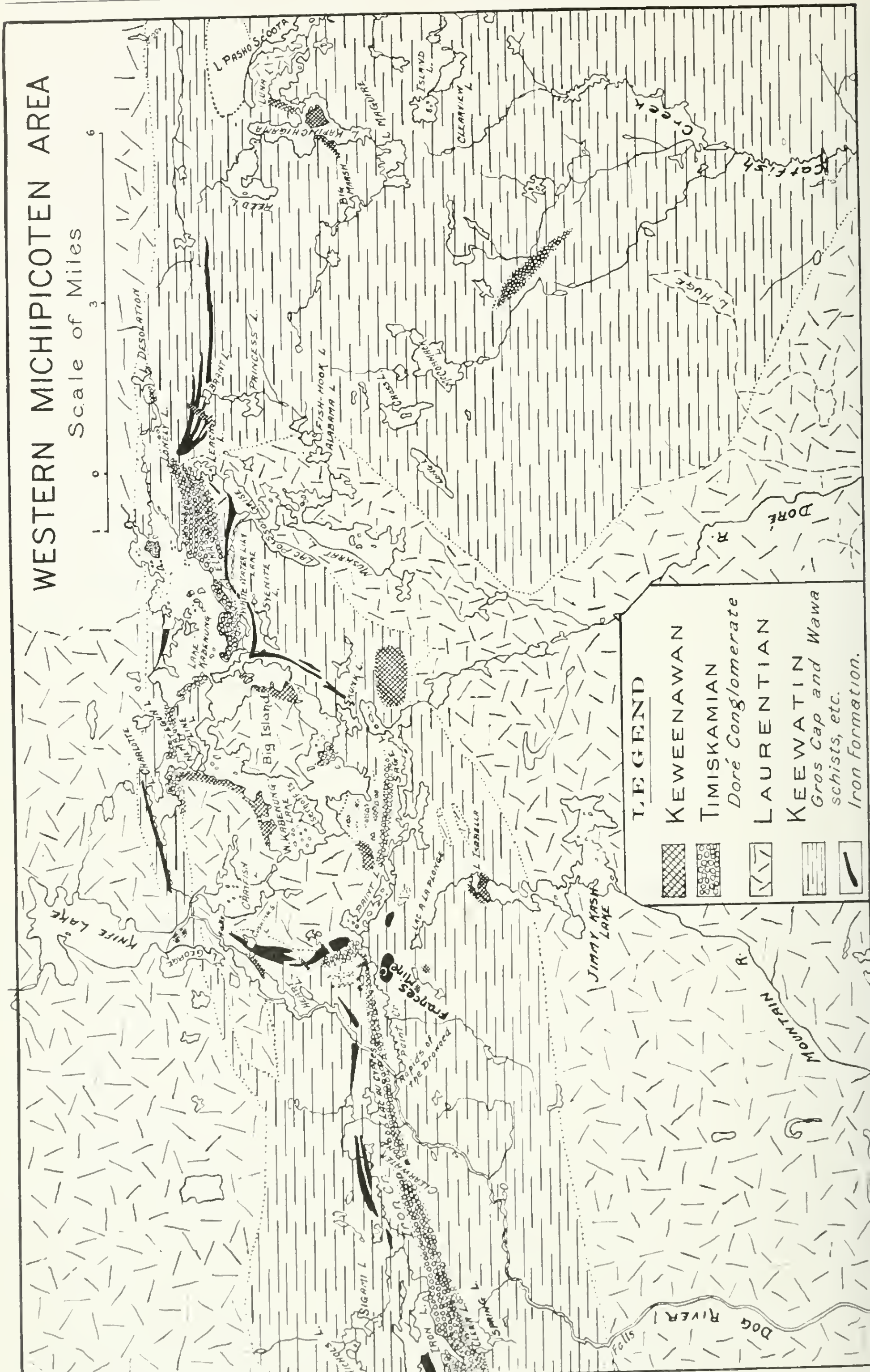
Coleman and Willmott subdivided this series into four, Gros Cap greenstone, Wawa tuffs, Helen iron formation and Eleanor slates.

J. M. Bell recognized the Helen iron formation on his map, and grouped the other three under the name of Michipicoten schists, etc., but in his text gives further subdivisions.

Coleman, adopting the classification of the international committee on pre-Cambrian nomenclature for the Lake Superior region, recognized the series, which he and Willmott had previously called "Lower Huronian," to be "Keewatin," and subdivided it into the Helen iron formation and the Gros Cap and Wawa schists and eruptives. These latter classifications with fewer subdivisions are more in accord with what has been found in other Keewatin districts where there is considerable variation in the rocks, but few structural breaks. For very detailed work, it would probably be well to make finer distinctions, but for all ordinary purposes the latter classifications are all that are necessary.

[2]Geol. Sur. Can., 1866, pp. 129-131.
[3]The term "Upper Huronian" having become practically meaningless, through its use in various senses by different authors, is here replaced by "Timiskamian" to conform with the nomenclature employed elsewhere.—C. W. K.


MAGPIE-GOUDREAU AREA
LEGEND
KEWEENAWAN
LAURENTIAN
KEEWATIN
Gros Cap and Wawa schists, etc.
Iron Formation.
Scale of Miles
½ 0 2
Morrison Claims
Goudreau Lake
Twin L.
Goudreau Mine
Herman Lake
Emily L.
A. C. & H. B. Ry.
Goudreau Siding
Alden Siding
Hamilton Pyrites Group
Smith L.
Jones L.
Dreany Claims
Long Rapids
Magpie River
Gravellis Claims
Ray L.
Eccles L.
Cedar Falls
Evan's Creek
Evan's Creek Iron Range
Johnston Claims
Magpie Mine
Magpie Branch
Alice L.
Emerald
Marion
Godon L.
Pyrrhotite L.
L. Pasho Scoota


WESTERN MICHIPICOTEN AREA
Scale of Miles
1 0 3 6
LEGEND
KEWEENAWAN
TIMISKAMIAN
Doré Conglomerate
LAURENTIAN
KEEWATIN
Gros Cap and Wawa schists, etc.
Iron Formation.
Knife Lake
Big Island
Dog River
Mountain R.
Doré R.
Catfish Creek
Jimmy Kash Lake
Frances Mine

Nearly all the Keewatin rocks of the region have developed schistosity, so that their original character is difficult to determine; but we can still distinguish the ellipsoidal structure of the original greenstones, and in many cases can find a distinct porphyritic texture in the more acidic tuffs and flows. Near the contact of the Keewatin with the Laurentian, the schists have undergone metamorphism, with the result that hornblende schists and mica (usually biotite) schists have been formed. In some cases, the two distinct types of schists are found in the same outcrop, and it appears probable that the hornblende type results from the re-crystallization of the more basic greenstones, and chlorite schists, while the biotite schists are produced by a similar change in the sericite schists. The Gros Cap and Wawa schists have been for the most part derived from igneous rocks. The Helen Iron Ore series, however, has been looked upon as a sedimentary series. This formation consists not only of iron ores, but of banded cherts, schists and bodies of calcite. The minerals present are such as might result from the decomposition of an igneous rock in the presence of water containing carbon dioxide and sulphur. The question to be settled is as to whether they are sediments or vein minerals. This is an exceedingly difficult problem to solve, as it is likely that the original structure of the materials has been lost. It may be said, however, that at the Magpie mine, the ore body is between schist walls which show little, if any, trace of quartz, either granular or cherty, and it has every appearance of being a vein. At the Goudreau pyrite deposits, there is a very large mass of calcite with the pyrite, and it may be questioned whether it is a sediment or a vein. Similar calcite is found near mile 180 on the Algoma Central railway, in veins and filling the interstices between the ellipsoids of the Keewatin trap. In cases where banded quartz is prominent, the sedimentary theory would appear to be the logical one, but even there it is by no means always certain that the quartz is not secondary, resulting from the alteration of the surrounding rocks in the formation of sericite schists.

Mr. C. W. Knight has kindly furnished the writer with several partial analyses of rocks in the vicinity of the Magpie mine which would indicate that much of the Keewatin rock in that vicinity is a rhyolite. These analyses were made by Mr. W. K. McNeill, Provincial Assayer, and show the silica percentage in four samples to be 71.10, 71.13, 67.36 and 70.06 per cent. respectively. This is decidedly more acidic than the Keewatin rocks of the Lake of the Woods region, though even in that locality there are sections which would approach these figures. In general, the typical Keewatin rock of the Michipicoten district is paler in colour than that of the Lake of the Woods region, and although colour cannot be looked upon as a guide in determining relative acidity, there is a tendency for the surface of the more acid rocks to be lighter coloured than the basic rocks.

Laurentian

The Laurentian consists principally of granites and gneisses with some syenite. Its contact with the Keewatin is characterized by brecciation and a re-crystallizing of the overlying Keewatin greenstones and schists. In the area covered by this report, the Laurentian is not a prominent feature, but it comes close to the border of the area in nearly all directions. The exact limits of this as well as of the other series are not exactly known, as the contacts are frequently covered with recent deposits of sand and gravel as well as by a more or less dense forest growth. In places where the Laurentian is exposed, it is sometimes impossible to mark the border with accuracy on a map of small scale, as the contact zone may be several miles in width and characterized by low dome-shaped hills of granite in sharp contact with re-crystallized Keewatin rocks, while the intervening valleys are filled with unconsolidated sands and gravels.

Since contacts of the granite and Doré conglomerate have not been discovered, it is possible that granites of Algoman age occur in the region.

Timiskamian

By far the most striking rock of this series is the Doré conglomerate, which was first described by Sir Wm. Logan[4]. In 1913, the Doré conglomerate was correlated with the Timiskamian series by Miller and Knight[5].

There has been considerable discussion as to whether the Doré is a true conglomerate or a volcanic tuff; but in the exposures at Michipicoten harbour there would seem to be no doubt of its true conglomeratic nature, for although most of the rounded pebbles and boulders are evidently of Keewatin age, there are granite boulders as well. The largest boulders are apparently Laurentian granite. That the rock is made up of fragments of different kinds of rock is well shown in Fig. 2, where there are boulders

Fig. 2—Doré conglomerate, Michipicoten Harbour

of banded and massive Keewatin rocks side by side, together with fragments which have evidently been squeezed and brecciated.

Although the sedimentary character of this material is so well shown here, it is by no means easy to determine beyond question the same origin for some of the deposits that have been referred to this formation. It is even possible that some of them may be Keewatin tuffs and agglomerates. In all doubtful cases, however, they are mapped provisionally as the Doré conglomerate.

Keweenawan

Throughout the entire region are to be found dikes of diabase cutting all the formations previously mentioned, with the possible exception of the Timiskamian. In appearance and texture, the diabase is similar to that of the dikes of the Lake of the

[4]Geol. Sur. Can. Rep. Prog. 1846-7, pp. 10-13.
[5]Ont. Bureau of Mines, Vol. XXII, Part II, p. 135.

Woods and of the sills of Port Arthur and vicinity, both of which have been referred, at least, tentatively, to the Keweenawan, though they may be later. The most that can be said definitely concerning the age of these dikes is that they are post-Laurentian, and probably post-Timiskamian; but they approach more nearly in character to the Keweenawan than to any other eruptive rock known in the Lake Superior region. The contact between these dikes and the adjoining rocks is usually characterized by a distinct band of very compact rock, due to sudden cooling of the molten material, but the central portion is coarser in grain, and shows the ordinary diabase texture, with occasionally quartz, in addition to the ordinary constituents. The effect of the dikes on the adjoining rock is not marked, although some re-crystallization has taken place. There is, however, a decided effect on the iron ores, as these are usually converted to mag-

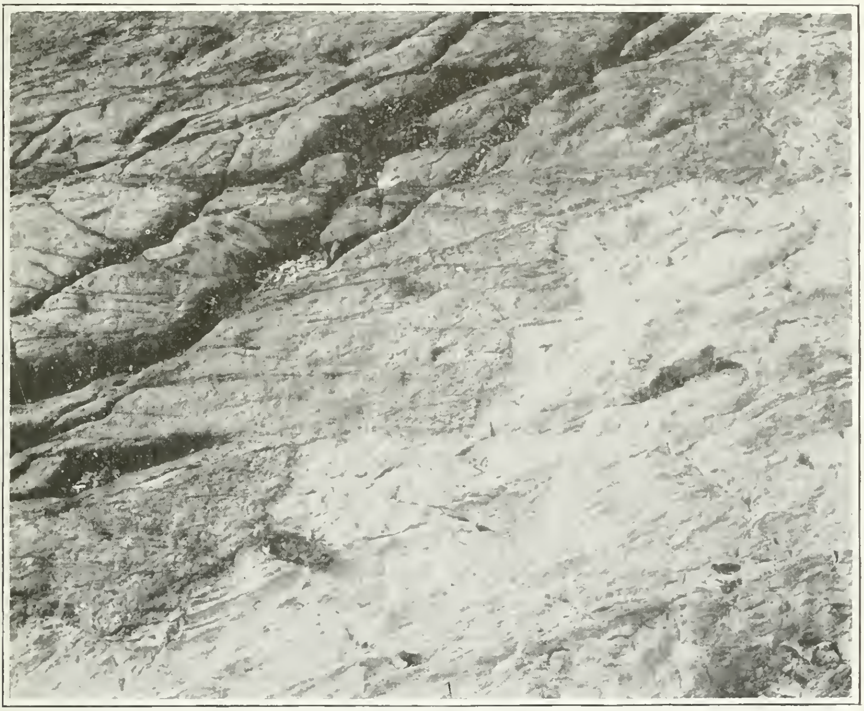


Fig. 3—Contact of Keewatin (light) with Keweenawan (?) dike (dark) showing movement, Brant lake claims

netite at the contact of the dike. A feature of unusual interest in connection with the contact phenomena is found on the margin of the dike on the Brant Lake iron deposits, where the dike has been subjected to movement. The original margin of the dike is marked by a distinct chill zone; but a movement has taken place in the direction of the planes of schistosity of the adjoining Keewatin rocks, and the chill zone is lacking in these secondary contacts that are thus formed (Fig 3).

Recent Deposits

The latest and possibly the most widespread deposits in this region have been least studied. They are glacial and recent deposits. The sediments are for the most part sands and gravels of a distinctly stratified character and are probably shore deposits, some of which have been deposited very near the parent rock mass. Some of these deposits are very deep and furnish excellent material for railway construction. Occa-

sionally there are to be recognized well-defined river terraces. The character of these deposits is shown in the railway cut near the bridge, over the Magpie river, on the Magpie branch of the Algoma Central railway (Fig. 4).

Rock Decomposition

In the past, reference has frequently been made to the comparatively slight decomposition observable in the rocks of the pre-Cambrian of Northern Ontario, which is attributed to the recent glaciation of the region, the decomposed material having been remived from the rock surface, leaving comparatively fresh rock exposed. But several rather striking examples of rock decomposition have recently been exposed in the cuts along the Algoma Central railway, and in some of the mines and diamond-drill holes, which give rise to interesting questions as to the extent of glaciation, and to the rapidity and extent of rock-weathering. In some cases, it even raises the question whether the smooth and striated surfaces attributed to glacial action have not been produced in other ways.

Fig. 4—River terrace near McKinnon Bridge, Magpie Branch, Algoma Central and Hudson Bay Railway

Examples of Kaolinization

The most striking example of rock decomposition which has been exposed in this region is in the Helen mine, where there are two notable deposits of kaolin, in addition to others of secondary importance, that have resulted from the decomposition of rocks of very different ages. The largest deposit of kaolin is due to the alteration of a diabase dike to a depth of several hundred feet. The dike is well exposed on the 300-foot level, and the decomposition is so perfect that the material can be taken out with a shovel. Although so entirely changed from its original condition, the original texture is preserved, and there is a distinct contrast between the products of decom-

position of the light and dark minerals of the original rock. In colour, the kaolin is nearly white and would appear to contain very little iron. On the sixth level the decomposition has not gone so far, but the dike is decidedly soft.

The kaolin from the 300-foot level has been analyzed by Mr. W. K. McNeill, with the following results:

	Per cent.		Per cent.
SiO_2	49.43	H_2O	11.85
Fe_2O_3	4.83	CO_2	0.52
FeO	Nil	TiO_2	1.33
Al_2O_3	30.49	S	0.24
CaO	0.30	SO_3	0.46
MgO	Tr.		
K O	0.48	Total	100.23
Na_2O	0.30		

The remarkable feature in this analysis is the almost total removal of the alkalies and alkali earths. The presence of almost five per cent. of ferric oxide in a nearly pure white clay indicates that it must be in some unusual combination. The possible compounds appear to be limited to the minerals pseudobrookite and nontronite. For the purpose of ascertaining the proportion of kaolin, sericite and quartz in the material, the above analysis was re-calculated. In this re-calculation, the iron was assumed to be largely combined with titanium dioxide, silica, sulphur and sulphuric acid, and the carbon dioxide was assumed to be combined with lime, soda and magnesia. While some of the minerals given are possibly absent, this process brings out correctly the chief features. The re-calculation gives:

	Per cent.
Kaolin	73.38
Sericite	3.98
Quartz	11.73
Calcite	.53
Magnesite	.11
Thermonatrite (doubtful mineral)	.63
Pyrite	.45
Coquimbite (doubtful in ratio of ferric sulphate and water)	1.10
Pseudobrookite (a somewhat unusual result of the alteration of ilmenite)	3.03
Goethite	.73
Limonite	.34
Nontronite	4.30

On the wall of the ore body below the eighth level the Keewatin rock is much decomposed, the result being a decidedly plastic kaolin of a banded and mottled character. This is at a depth of 540 feet. In colour, the material is decidedly yellow, and there are nodules of goethite scattered through the mass. A sample of the material was analyzed by Mr. McNeill, with the following result:

	Per cent.		Per cent.
SiO_2	59.36	H_2O	6.48
Al_2O_3	24.66	CO_2	Nil
Fe_2O_3	6.26	TiO_2	Nil
FeO	Nil	S	Tr.
CaO	Nil	SO_3	Nil
MgO	Tr.		
K_2O	2.11	Total	100.09
Na_2O	1.22		

In re-calculating this analysis, the iron was assumed to be present as goethite on account of the colour of the clay and the inclusions mentioned above. Soda and potash were calculated as sericite, and the alumina remaining after this was calculated as kaolin.

The result shows:

	Per cent.
Kaolin	30.76
Sericite	32.17
Quartz	30.10
Goethite	6.96
	99.99

The original rock in this case was a Keewatin schist, which probably represented an altered phase of an igneous rock in which the feldspars had been changed in part to sericite before the process of kaolinization began. It shows in the field a feature connected with kaolinization that has been proved by laboratory tests—that the unaltered feldspars are more readily converted into kaolin than the muscovite or sericite, which is intermediate in composition between the feldspars and kaolin.

Drill cores at the Josephine mine also show specks of kaolin in the iron ore. It is thus evident that under certain conditions the kaolinization of the pre-Cambrian rocks in this region has extended to great depth. Apparently this is in accord with the experience elsewhere in the pre-Cambrian, particularly in the iron deposits of Minnesota.[6]

Effects of Freezing Water

Another type of rock disintegration is due to water freezing in crevices in the rock, thus breaking the mass into angular fragments. This process, once begun, is materially assisted by the roots of trees growing in the crevices thus opened, and a decided impression may be made upon the rock by the solvent action of organic acids in or near the vegetable growth. A marked example of the early stages of such disintegration of rock masses is shown on the shores of Crayfish lake (Fig. 5), where the granite shores are bordered with angular fragments of granite. On a small island near the north end of the lake this is well shown; and the effect of the weather on two kinds of rock may be compared. At this point a diabase dike cuts the granite, and while the granite is usually rough the surface of the diabase is decidedly smooth. While the granite fragments are angular, the diabase fragments are rounded.

A similar phenomenon, but in a more advanced state of change, is shown near mile 162 on the Algoma Central railway, where large accumulations of decomposed material rest on the smooth surface of the underlying rock. The nature of this material is shown in Figs. 6, 7, 8. In general, the fragments of rock are angular but weathered, and under ordinary conditions would probably be considered to represent a glacial phenomenon. This, however, is probably not the case, and the smooth surface observed under one of the exposures (Fig. 8), is in all probability caused by a creeping of the brecciated material locally. The reason for suggesting a cause so different from the one commonly accepted is derived from a comparison of the underlying with the decomposing rock. At this point both Keewatin and Laurentian rocks are present, and we have the characteristic features of the Laurentian-Keewatin contact: bosses of granite surrounded by Keewatin rock, and occasional hills upon which the only rock to be seen is Keewatin. If these were glacial deposits it would be natural to expect a heterogeneous mixture of rocks from both formations. This, however, is not the case, but as a rule the rocks that are undoubtedly Keewatin are covered with a mantle of angular Keewatin débris, while the Laurentian rocks are characterized by a mantle of Laurentian débris. The contact between the two is characterized by a mixed deposit. The only place where rounded boulders were observed at this point was in a small valley where there had, evidently, been opportunity for the action of running water to remove the products of decomposition (Fig. 9).

[6]Geol. & Nat. Hist. Surv. of Minn., Bull. X, p. 147.

Fig. 5—Angular granite fragments, Crayfish lake

Fig. 6—Partially decomposed pre-Cambrian rock in place, showing angular fragments in the railway cut near Mile 162, A.C. and H.B. Railway

Fig. 7—Partially decomposed Keewatin rock in place near Mile 162, A.C. and H.B. Railway

Fig. 8—Partially decomposed Keewatin rock overlying polished surface of Keewatin rock. The polishing is probably due to creeping of the overlying material.

Economic Products of the Region

Iron Ore

By far the most important product of the Michipicoten area at the present time is iron ore, which is mined in the form of siderite at the Magpie mine, and as hematite and goethite ($Fe_2O_3.H_2O$) at the Helen mine. The mining of other materials is in the development stage, and is described on following pages. In addition to the classes of iron ore mentioned there is magnetite, which is the principal material at the Dreaney claims.

Pyrite

Second in importance to iron ores is pyrite, with which may be mentioned pyrrhotite. The principal deposits are on the Goudreau and Morrison claims and at the Helen mine, though there are other smaller deposits which are mentioned below.

Sufficient data are not available for making a careful estimate of tonnage, but with the completion of the drilling of the Goudreau deposits some idea can be obtained of the quantity there.

Kaolin

The kaolin of the Helen mine, described in a preceding paragraph, is of economic interest. This deposit, together with others of lesser extent, are described under the head of "Rock Decomposition" and in connection with the Helen mine.

Gravel and Sand

These materials which, in this region, find their greater application in the construction of railways, are found in large stratified deposits which are in part river terraces, and in part shore deposits.

Transportation

Since the last report on this region was published, the transportation facilities have been wonderfully improved by the completion of the main line of the Algoma Central and Hudson's Bay railway from Sault Sainte Marie to Hearst on the National Transcontinental railway, and by the extension of the Michipicoten branch from Josephine junction to Hawk Lake junction, as well as by the construction of the Magpie branch.

The ore is shipped to Michipicoten harbour, and thence by boat. For a time shipments were made by rail to Sault Sainte Marie.

Origin of the Ore Deposits

In this region there are six minerals which are used either directly or indirectly as ores of iron. These are the *carbonate*, siderite, *three oxides*, hematite, brown ore[7] and magnetite; and *two sulphides*, pyrite and pyrrhotite. These are found in such conditions that it would appear necessary to assign a common origin to them all, though the association of the minerals at various mines might indicate a variety of origins, if all the factors were not known.

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[7]Under the head of brown ore there are four minerals which, when pulverized, are yellow brown in colour. They differ from one another in the amount of water that is combined with ferric oxide. These are goethite, $Fe_2O_3.H_2O$; limonite, $2Fe_2O_3.3H_2O$; xanthosiderite, $Fe_2O_3.2H_2O$; and limnite, $Fe_2O_3.3H_2O$. For commercial purposes they are all called brown iron ore, limonite or brown hematite.

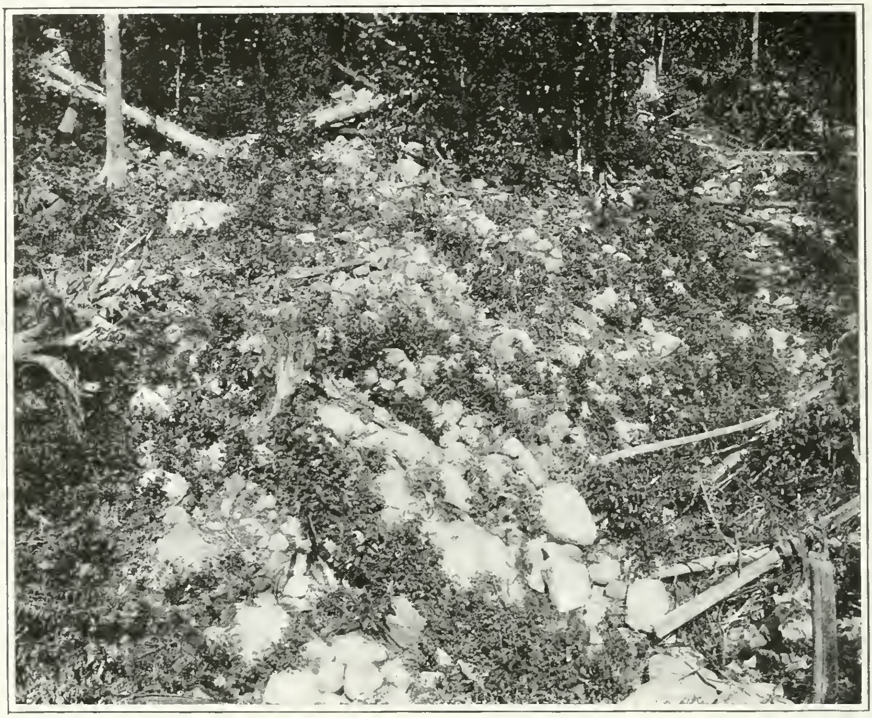

Fig. 9—Rounded boulders, principally granite, in ravine near Mile 162, A.C. and H.B. Railway, showing effect of running water on the material seen in Figs. 6, 7 and 8

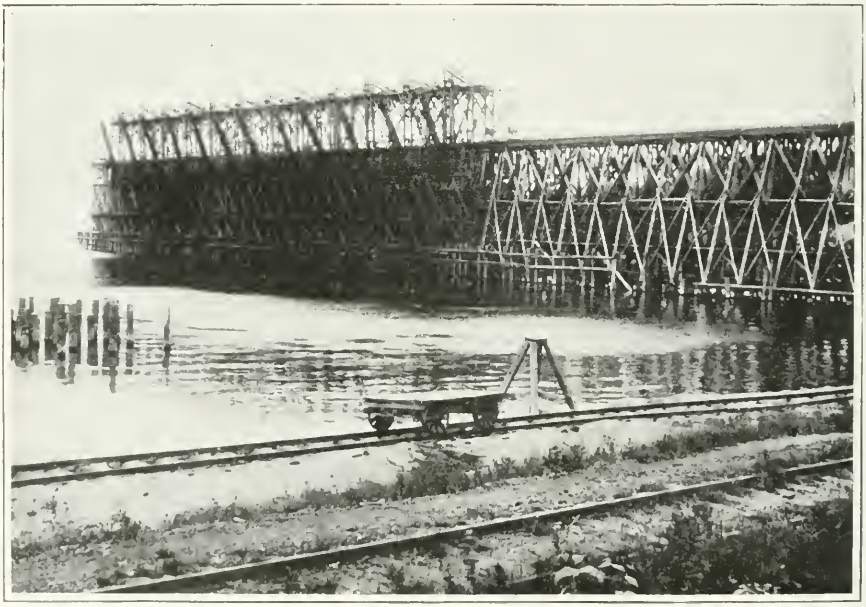

Fig. 10—Ore dock, Michipicoten Harbour

Magpie Mine

The Magpie mine was first opened up in 1911 on a large body of siderite which when roasted furnishes a Bessemer ore of fair quality. No shipments were made during 1911 and 1912, but development work was carried on so as to expose a large tonnage of ore. The ore that was taken out was put in a stock pile. The extreme depth of the mine is about 250 feet. The shaft contains four compartments, which provide for two skips, one cage and a manway. Two main levels have been opened up, 125 feet and 205 feet respectively below the surface, and the ore is secured by stoping from sub-levels. By this method of mining all the ore is secured as the wall is good. West of the shaft the ore body is cut by a trap dike, 95 to 105 feet wide, which forms a good pillar. The ore body is about 50 feet wide, and has been developed for a length of about 1,500 feet. Unlike the deposits of oxidized ore in this region, this deposit shows no trace of the typical banded iron formation consisting of quartz and iron ore, but its walls are the typical sericite and chlorite schists of the

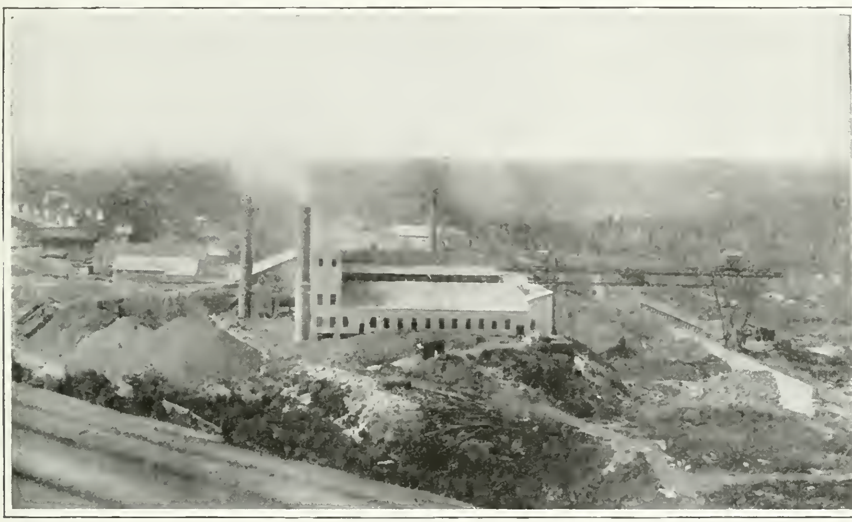

Fig. 11—Magpie mine, showing head frame, roasting plant, stock, and some of the dwelling houses

Keewatin. On the surface the rock near the mine consists not only of ellipsoidal greenstone but of brecciated material together with some tuffs and sericite schists, and it is somewhat difficult to tell where one begins and the other ends. The appearance of this body of ore points to its origin as a vein.

Electric power which is generated at Steephill falls, Magpie river, is used for all power purposes at the mine. The ore when brought to the surface is crushed and put throught roasting kilns of the type used in making Portland cement, from which it goes to the stock pile to cool. In the siderite small crystals of pyrite are occasionally found, but in roasting the sulphur is practically all removed so as to give a Bessemer ore of fair quality. The capacity of the roasting plant is about 20,000 tons per month.

The average composition of the shipments of finished or roasted ore for 1914 was as follows:—

Iron	Phos.	Silica	Manganese	Alumina	Lime	Magnesia	Sulphur	Loss
50.00	.012	9.00	2.71	1.02	8.79	7.05	.178	None

This is a self-fluxing ore.

About 250 men were employed at the mine during the summer of 1914.

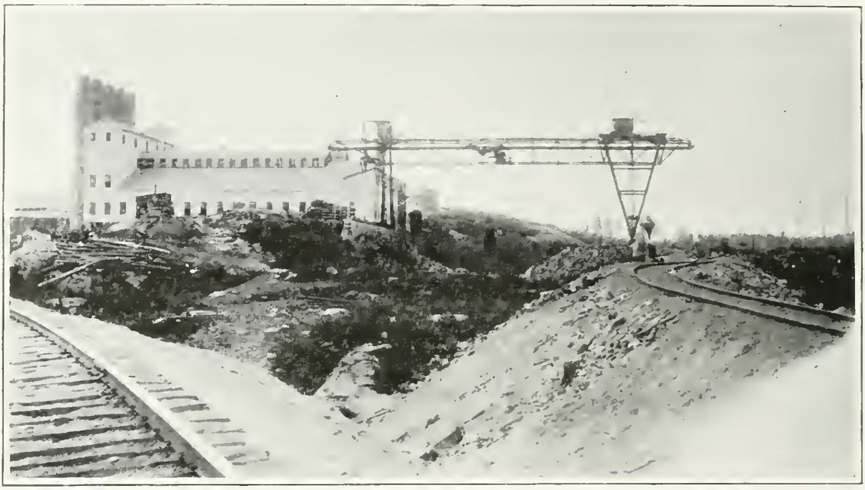

Fig. 12—Magpie mine, showing roasting plant and stock pile for roasted ore

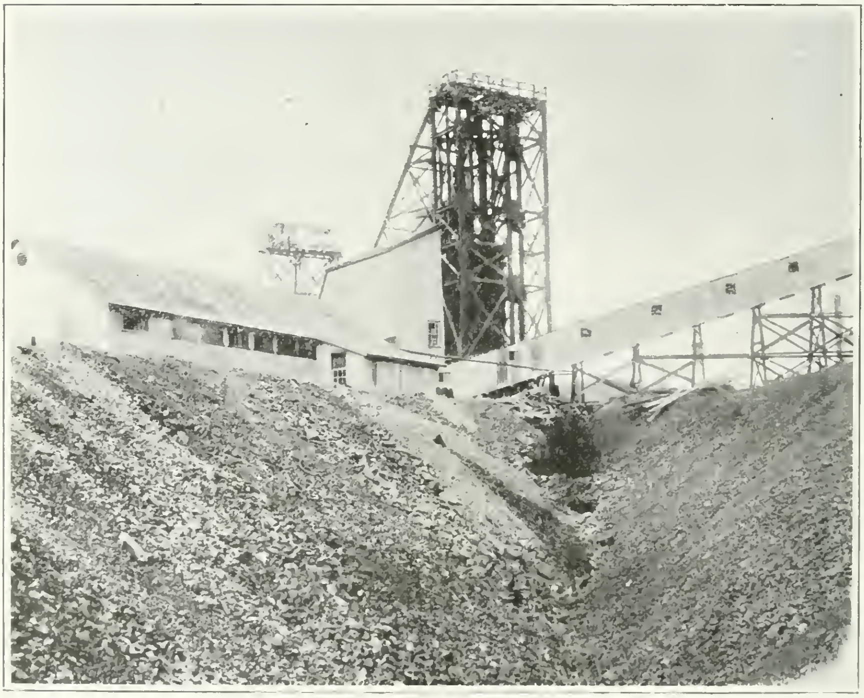

Fig. 13—Head frame, Magpie mine

Fig. 14—Iron Knob, near Magpie mine

Fig. 15—Head frame and stock of raw ore at Magpie mine

Mining operations conducted since the field season closed have carried the shaft to the 300-foot level, and with the sump the total depth of the shaft is 337 feet.

Mr. C. W. Knight took samples of the raw and roasted ore in 1913, and the analyses which were made by Mr. W. K. McNeill were contributed by Mr. Knight for this report. The analysis of the roasted ore agrees well with the average shipments for 1914, but is slightly higher in iron and lower in phosphorus and sulphur, as will be seen from the following:

Roasted Ore.	Per cent.
Fe	50.25
S	0.115
P	0.009

Raw Ore.	Per cent.
Insoluble	3.40
$FeCO_3$	53.20
FeO	3.50
Fe_2O_3	8.40
$CaCo_3$	9.79
$MgCO_3$	11.57
$MnCO_3$	4.60
Iron (metallic)	34.30

Helen Mine

This mine, which is the oldest productive mine in the region, was opened up early in 1899. Descriptions of it are to be found in several of the annual volumes of the Bureau of Mines. Originally, it was located as a gold prospect, but the discovery of a large body of red and brown iron ore resulted in its development as an iron mine. Up to the present time nearly all the work on the mine has been devoted to securing the oxidized iron ores, but recently attention has also been given to utilizing the pockets of granular and massive pyrite which have been mentioned in earlier reports.[8] For the most part there has been no effort to save the pyrite except when a 40 per cent. product could be secured, but during the past summer a concentrating plant was installed to separate the pyrite from ore that is too high in sulphur to be utilized directly as an iron ore. The decreased reserves has led to a search for further supplies of satisfactory ore, and it is expected that the large deposit of siderite which lies to the east of the oxidized ore will be developed in the near future. The amount of oxidized ore in reserve is sufficient for several years' mining at the rate of production for the past year; but sooner or later it must be exhausted, and in certain parts of the mine the unoxidized siderite has already been encountered in the lower levels.

The ore bodies at the Helen consist for the most part of goethite, a hydrous oxide of iron, but with it is some hematite and probably other oxides containing various amounts of water. These ore bodies lie in a depression beneath hills which rise from 300 to 450 feet above the level of Boyer lake, except at the outlet of the lake where there is a solid rim of rock over which the water flowed before the lake was drained. It would appear that at some time the level of Boyer lake was at a considerably higher elevation, and that the formation of the Helen body of oxidized ore was largely due to the presence of this body of water, as the quantity of goethite corresponds approximately to the alteration product of a mass of siderite extending upward to the level of the siderite outcrops to the east. The ore bodies are separated by a diabase dike which outcrops both on the north and south sides of the lake, but apparently is not present on the lake bottom. This apparent absence of diabase at this point is due to a precipitate of yellow ochre which covers a ridge that is slightly higher than the rest of the lake bottom, and it is possible that excavation at this point would fail to reveal any easily recognizable trace of diabase rock. The reason for this is to be seen

[8]Ont. Bureau of Mines, Vol. XVI., Pt. 1, pp. 165-170.

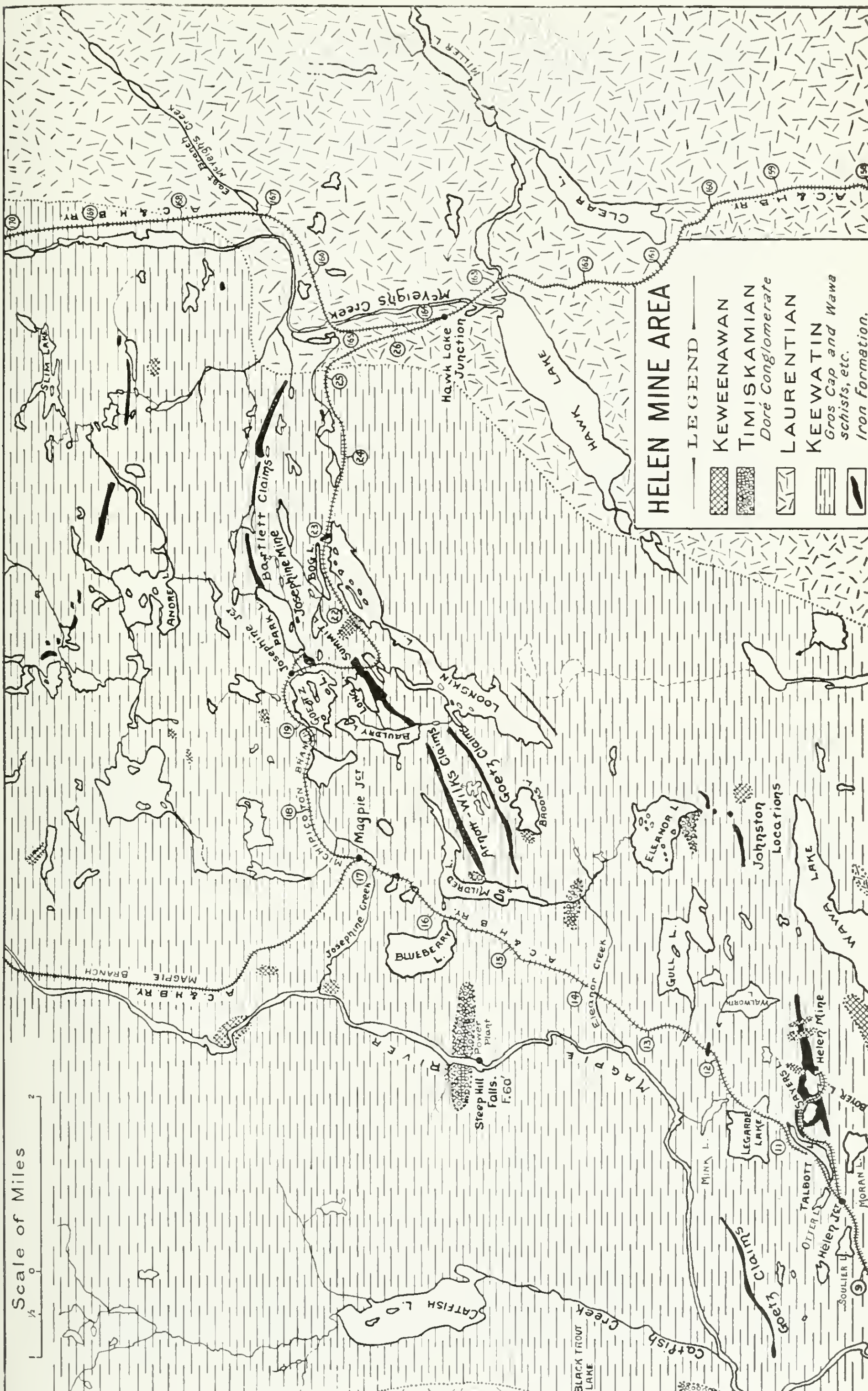
HELEN MINE AREA
LEGEND
KEWEENAWAN
TIMISKAMIAN
Doré Conglomerate
LAURENTIAN
KEEWATIN
Gros Cap and Wawa schists, etc.
Iron Formation.
Scale of Miles
Helen Mine
Josephine Mine
Bartlett Claims
Goetz Claims
Arnott-Wilks Claims
Johnston Locations
Hawk Lake Junction
Magpie Jct
Josephine Jct
Helen Jct
Steep Hill Falls. F.60'
Power Plant
Magpie River
Hawk Lake
Clear L.
Wawa Lake
Catfish L.
Catfish Creek
Eleanor Creek
Josephine Creek
McVeigh's Creek
East Branch McVeigh's Creek
Loonskin L.
Blueberry L.
Eleanor L.
Gull L.
Legarde Lake
Sayers L.
Boyer L.
Mink L.
Moran L.
Soulier L.
Talbott L.
Otter L.
Black Trout Lake
Mildred L.
Brooks L.
Bog L.
Slim Lake
Anore L.
Walworth L.
Miller L.
A. C. & H. B. RY.
Magpie Branch
Michipicoten Branch
A. C. & H. B. RY. Magpie Branch

Fig. 16—Residual Kaolin (white spots) in iron ore at Helen mine

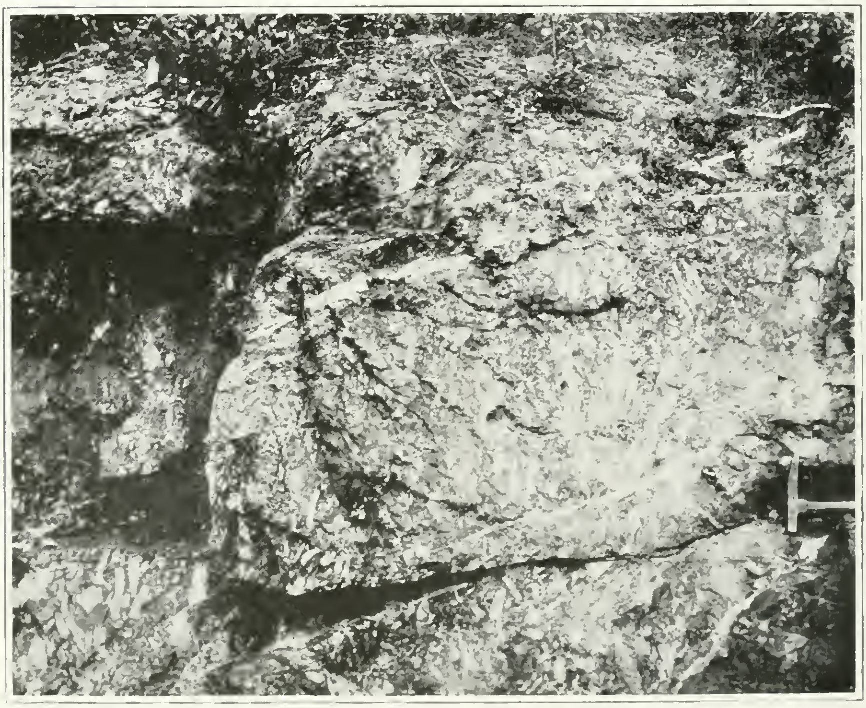

Fig. 17—Brecciated Iron formation near Helen mine

in drifts which have been run through the dike to reach the ore bodies under the lake. This is particularly well shown on the third level, where the dike has been so completely kaolinized that it is readily excavated by pick and shovel. The kaolinized mass preserves the texture of the original diabase, and the dark minerals are apparently not so completely altered as the feldspars. That an intimate relation exists between the oxidation of the iron ore and the kaolinization of this dike is evident when we note that on the north side of the ore body the dike is apparently unaltered, and in the lower levels where the oxidation of the ore is not so complete the kaolinization has also been less complete. It is apparent, however, that certain chemical changes are still in progress, at any rate in connection with the oxidation of the ore, if not with the kaolinization of the dike, as there is a decided increase in temperature in the lower levels that cannot be accounted for by depth alone. In places the ore is warm to the touch, and there is a certain amount of steam which can hardly be accounted for except by chemical action. The kaolinization of a diabase dike is rather unusual, but it would appear to be natural in the presence of iron carbonate and an oxidizing agent, as we have in that case a source of carbon dioxide in water which is apparently all that is necessary for the kaolinization of the feldspars in the diabase.

In certain parts of the mine kaolin and quartz are prominent as inclusions in the ore, and in such cases represent the decomposition products of fragments of the country rock. This is shown in Fig. 16, which was taken in one of the lower levels. The light spots in the picture show the distribution of the kaolin, while the darker portion is ore. On account of the presence of this type of material the ore is passed over a picking belt to remove the impurities.

Samples of the residual clays from the dike and the Keewatin contact were submitted to Mr. J. Keele, of the Geological Survey of Canada, who has kindly tested them for their availability in commercial work. The result of these tests appears as an appendix to this report.

Josephine Mine

The workings of the Josephine mine were abandoned some years ago, presumably because a sufficiently good ore body had not been encountered. The old workings that are visible would seem to indicate that considerable attention had been paid to a ferruginous sericite schist on the south shore of Parks lake, which weathers to an ochre yellow colour, and was mistaken by the writer at first for a low-grade ore body. Recently, however, the Algoma Steel Company have explored the property with the diamond drill with the result that a satisfactory body of hematite was found under Parks lake. This ore body does not show up satisfactorily on the shores of the lake, but appears to be a continuation of the Bartlett ore body and may possibly connect with the Goetz deposits at mile 21 on the Michipicoten branch of the Algoma Central railway. Plans were made for draining Parks lake and making the necessary railway sidings to develop the property, but these plans were postponed on the outbreak of the European war.

It is interesting to note the presence of this body of oxidized ore beneath the lake, as this is the second body of the kind in the Michipicoten region, the other being the Helen ore body. It is, of course, impossible to make any definite statements in regard to the genesis of this body, but in some drill cores it was noticed that small specks of white kaolin and some minute quartz crystals were present in the hematite, indicating the probability that a similar oxidation of siderite and kaolinization of feldspars with the consequent formation of quartz have been in progress here.

Iron Mountain or Dreany Claims

This range, which is locally known as the "Dreany claims," is probably the longest in the region, and is located near the contact of the Laurentian and Keewatin formations. It crosses the Algoma Central railway about four miles north of Goudreau siding. The range is known to extend about four miles west of the railway, and it is

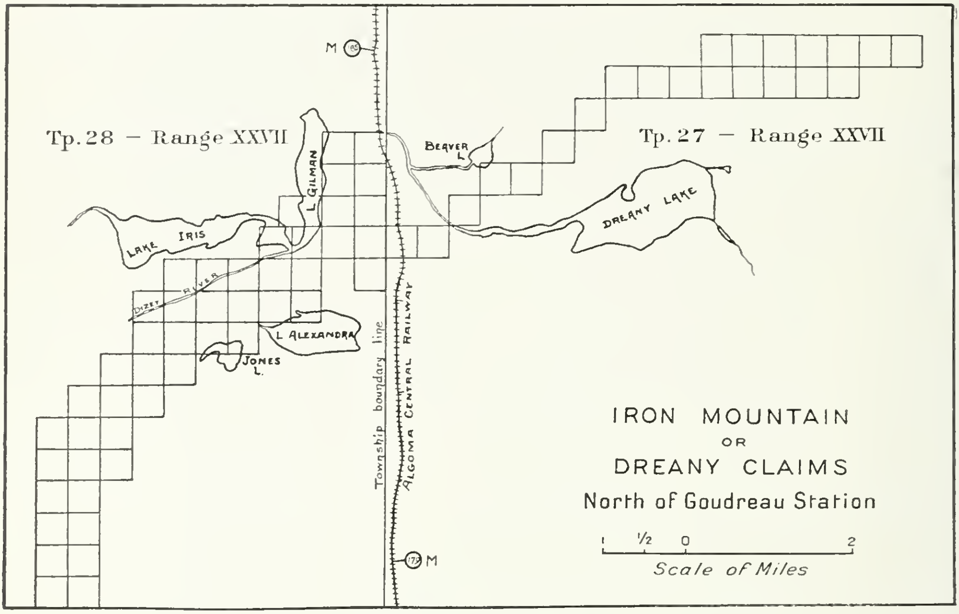

Fig. 18—Banded and brecciated Iron formation, Dreany claims

said to extend for about the same distance to the east. The ore is, so far as seen by the writer, magnetite, which is interbanded with quartz, epidote rock and garnetiferous hornblende schist. The deposit on the west side of the railway is well trenched, and it is the intention to drill the property in the near future. At the time when the property was visited there were about a dozen men employed in stripping.

A striking feature of portions of the deposit is the presence of large quantities of epidote, which, in places, is the predominant mineral in the adjoining rock, and at times is the principal mineral interbanded with the magnetite. In places, the banded material is badly brecciated (Fig. 18), but this does not extend to the entire formation, as is shown in the illustration. In this case, the brecciated material consists principally of epidote and magnetite, while the evenly banded material is principally quartz and magnetite. This deposit is similar to the iron deposits near Dryden, though epidote is not so prominent in the latter deposits.

Johnston Claims

The entire range on these claims was not covered by the writer, as there was, apparently, no very recent work. The banded iron formation near the old camps is exposed in several trenches for a width of from twenty to thirty feet. So far as seen, there was no body of high-grade ore, but the iron was distributed in thin layers inter-

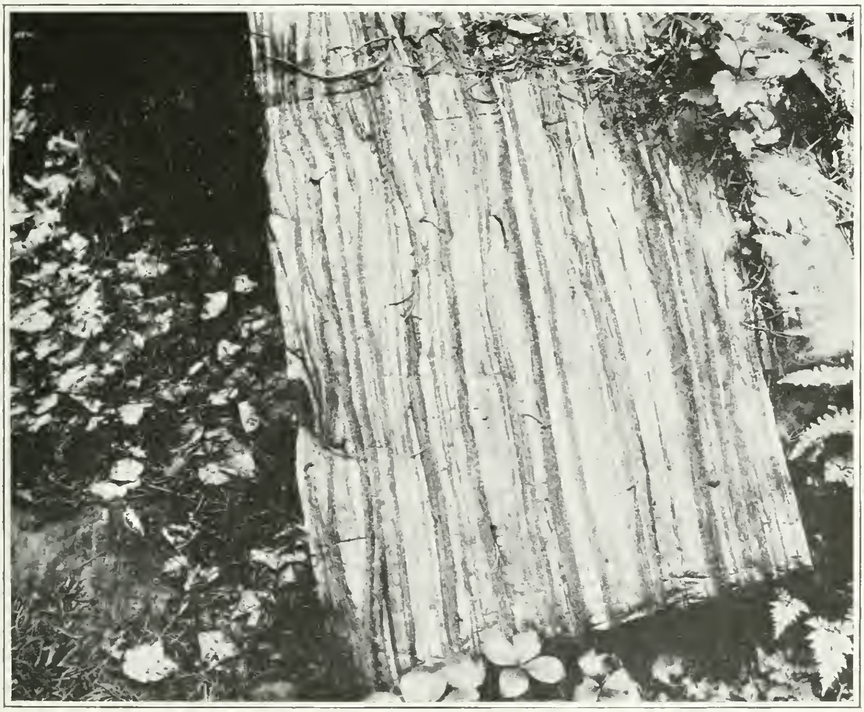

Fig 19—Banded iron formation, Johnston claims

banded with quartz. Both magnetite and hematite are present in the iron bands, but magnetite is probably the more abundant. The quartz bands are, in many cases, decidedly lenticular (Fig. 19). This deposit is in the region near the contact with the Laurentian rocks, and was probably originally a siderite deposit which has been altered by regional metamorphism.

Access to these claims is easy from the old tote-road from Michipicoten harbour to Grasett.

Frances Mine

The only rocks visible at the Frances mine are those of the Helen iron formation. These are characteristically banded, and consist of quartz, hematite and siderite. In places they are badly crumpled and brecciated, as is shown in Fig. 20, which photo was taken in an area about twelve feet square. The body as a whole is low grade, and the writer was unable to discover any large body of pure iron ore. The property has been

Fig. 20—Contorted Iron formation, Frances mine

drilled, but apparently without finding an adequate supply of ore to warrant extensive mining operations, and the construction of the railway necessary for the transportation of the ore. To utilize the ore that is here it would be necessary to concentrate, which, at present prices for ore, would not be profitable.

Goodwin Deposits

Two men were engaged in stripping on the range on the east side of the Magpie river during the summer. Dip needle observations had given encouraging results, and a small outcrop of limonite had been found, but the development has not yet shown a body of commercial value.

Brant Lake Claims

The iron formation on these claims is represented by five branches of one main body, as determined by Dr. J. M. Bell.[9]

In many respects this is a promising deposit, as there are some small bodies of pure ore in addition to the more prominent banded deposits. The good ore, so far as known, is at the contact of a dike of diabase, and consists principally of magnetite,

[9]Ont. Bureau of Mines, Vol. XIV, Part I, p. 330.

with some hematite. The banded deposits are principally of quartz and hematite, but are apparently too low in iron to be commercially profitable at present. Although there are some bodies of ore free from quartz which would furnish a high-grade iron ore, these are not of sufficient size to warrant their development. The property has been drilled, with disappointing results.

Iron Lake Deposits

The iron range on Iron lake extends in a westerly direction from Red Pine point for a distance of about five miles, and is one of the largest exposures of iron in the region. Unfortunately, the exploration of the properties with the drill and by trenching has failed to bring to light an adequate quantity of commercial ore, so that the properties stand idle. The surface showing of iron is probably better than at any other place in the region, as the rocks are generally coated with red hematite, which has encouraged various people to expend large sums of money in the search for a commercial body of iron ore. The time at the disposal of the writer was very limited, so that only a very superficial examination could be made and only a few of the former workings were seen. From what was seen, however, it would appear that the formation is a highly silicious carbonate of iron, or possibly it would be better to call it a ferruginous chert, which has been oxidized on the surface and in crevices so that much of the surface is red. When this rock is broken the interior is a gray or creamy chert with a red surface. The better deposits described by Dr. Bell, which occur at the margins of some diabase dikes, were not seen. The most encouraging feature noted by the writer was, however, not on the land but in the extension of this deposit under the waters of Iron lake, where the dip needle gave a reading of about 50°. Although this may not be looked upon as proof that a good body of ore is present here, it is encouraging when we consider that the bulk of the oxidized ores of the Helen and Josephine properties are located beneath lakes.

Holdsworth's Pyrite Claims

Near Mile 24 on the Michipicoten branch of the Algoma Central railway are two claims which are being developed by John Holdsworth. The encouragement for this work is found in some large masses of pyrite along the shore of a small lake. Some of these masses are as much as twelve feet in diameter, while smaller boulders of the same material are abundant.

So far as exploration has shown, there is no large body of pyrite in the rock on the shore, and it still remains a question whether these masses indicate a body of pyrite below the surface of the lake, or are merely erratics.

Other claims which are being prospected by Mr. Holdsworth are near the south end of Loonskin lake, where a small patch of iron formation was mapped by Coleman and Willmott. At this place there is a small body of pyrrhotite with some chalcopyrite, but the present workings have not yet exposed a deposit of commercial importance.

Arnott-Wilks Claims

This property, which was formerly known as the "Ross-Arnott Claims," consists of a large iron-bearing formation, which for the most part is siderite of a more or less silicious character. Like the other siderite bodies in the region it contains small crystals of pyrite scattered through it, but not in sufficient quantity to be a serious detriment. An encouraging feature in connection with this property was shown in one of the pits beside a swamp near the Mildred lake end of the range, where the siderite has begun to oxidize, with the formation of ore like that at the Helen mine as the result.

A feature which this oxidized ore shares with other oxidized ores is the presence of sand-like pyrite filling some of the vugs. When it is considered that the siderite usually shows only scattered crystals of pyrite, it would appear that these large

accumulations of pyrite must result from a conversion of part of the siderite to pyrite by sulphur-bearing waters, or they represent an underground sediment resulting from the deposition of pyrite crystals as the surrounding siderite is removed and oxidized. This latter would appear to be the better explanation.

Further exploration of this deposit is desirable to ascertain the extent of the oxidized ore. This deposit appears to be the southwesterly extension of the Bartlett-Josephine-Goetz range.

Goetz Claims

There are three deposits which are known as the Goetz claims, the first crossing the railway at mile 21 and extending in a southwesterly direction to the south end of Bauldry lake, the second lying to the south of the Arnott-Wilks claims, and the third to the west of the Helen mine. The last of these was not visited by the writer.

The first of the deposits has been prospected extensively, and offers encouragement for the development of a large body of ore of low grade. The writer does not know the average grade of this body, but it is stated to be a silicious siderite carrying about 35 to 38 per cent. of iron.[10] This would, if roasted, produce about a fifty per cent. ore.

In connection with this deposit is a body of pyrite about 20 to 30 feet wide, outcropping in the railway cut near mile 21 of the Michipicoten branch. If this is more than an isolated pocket, it should furnish a more valuable product than the siderites, as the market for pyrite in the lake region offers a better price than can be obtained on the seaboard. Even a low-grade deposit of pyrite, if of large size, would in many cases pay for concentration in this region.

The deposit south of the Arnott-Wilks property is characterized for the most part by a banded character, and does not offer much encouragement, but toward the west end a deposit of siderite is exposed which has been oxidized on the surface to hematite. This body is over 100 feet wide on the outcrop and shows very little foreign material.

Bartlett Claims

To the east of the Josephine property the iron body extends on the Bartlett claims more or less continuously for seven claim lengths, or about one and three-quarter miles. The best exposure is on a hill north of Siderite lake, where a large body of siderite has been drilled and trenched. The average width of the body is from 40 to 60 feet and the quality is good.

The ore body as a whole consists of siderite which has been altered on the surface to limonite or goethite and hematite. In places the siderite is decidedly pyritous, and some masses of pyrrhotite were seen, but in general the siderite appears to be of good grade. Some of it has been fractured, and in the seams between the fragments is goethite, which results from the oxidation of the siderite. In certain cases the original siderite has been entirely removed and only the goethite remains, surrounding the cavity which represents the siderite. Occasionally a nodule of siderite remains in the cavity. In the process of oxidation the pyrite does not appear to be much affected, and is found both as sandy material in the vugs, and embedded in the goethite.

To the south of Siderite lake is another range of ferruginous rock which is an iron-bearing sericite schist. This body appears to be as persistent as the ore body to the north, and is possibly continuous with similar deposits on the south side of Parks lake and on Leg lake. These are possibly the northeasterly continuation of the siderite deposits and banded iron formation found on the Goetz claims north of Brooks lake. This formation on the Bartlett claims does not appear to be of economic importance.

Gibson Claims

On this property, as seen by the writer, there is a band of siderite about ten feet wide between banded iron formation. This iron formation is about ten feet wide on each side of the siderite.

[10] Ont. Bureau of Mines, Vol. XI. p. 173.

Goudreau Pyrite Claims

These claims lie to the east of Goudreau siding, and are reached by a good wagon road which extends to the Morrison claims beyond.

At the time of the writer's visit the deposits were being prospected by the Madoc Mining Company under the superintendence of Mr. J. Battle, Jr., who kindly went with the writer over the outcrops of ore and rock that had been found. There are 27 claims in all, covering an area of between 900 and 1,000 acres. They are in a great flat, which is covered with swamp and sand for the most part, and the pyrite is found in rounded knobs projecting above the level of the surrounding country. Samples from some of the drill cores were kindly furnished for microscopic examination. These show that in what is known as the "A" deposit the pyrite is associated to a depth of about two hundred feet with calcite as the predominant mineral. In some parts of the core this calcite appears to be like the Grenville limestone of eastern Ontario, and the question is raised as to its origin. In other parts the pyrite is nearly pure, while all gradations between pure limestone and pure pyrite may be found. In the bottom of the hole some garnet was found. On deposit "D" the amount of garnet is somewhat remarkable, and it is intimately associated with pyrrhotite in one hole.

The most interesting of the deposits in showing relations to the older rocks is on what is known as the "Bear claims," where the pyrite is in an almost vertical position between schist walls, and appears to be a vein. Mr. Battle informed the writer that in the other properties, with the exception of the "E" deposit, good walls had not been found. On these claims there is a large deposit of bog iron ore, covering about six acres. This has been prospected by a few test pits, and in the pit seen by the writer the depth of the iron ore is at least six feet. This deposit is apparently derived from the oxidation of the pyrite bodies.

On the "E" deposits the pyrite is also bounded by rock on both sides. This rock is banded, and has been referred to the iron formation.

The deposits are of promise, and much of the ore is of marketable grade without concentrating. There is also a large amount that, although of too low grade to be marketable as mined, would pay for concentration.

In all there are seven prominent outcrops, with an estimated total outcrop of 283,500 square feet, divided as follows:—

Bear claims	200 x 1,200 ft.
"A" deposit	50 x 75 "
"B" "	50 x 200 "
"C" "	50 x 300 "
"D" "	50 x 75 "
"E" "	50 x 150 "
"F" "	20 x 200 "

Morrison Pyrite Claims

These deposits are about five miles in a northeasterly direction from the Goudreau camps. There are two distinct veins here which have been exposed by trenching. The greatest width observed in the wider vein is about 25 feet. Along the strike of the vein the outcrops are interrupted by swamps, so that it cannot be stated that there is a continuous deposit; but the probability of continuity is strong. The walls of the vein are schist, containing considerable gypsum. In places the pyrite is found filling the spaces between the ellipsoids of pillow lava. The property is under option.

Hamilton Pyrite Claims

These deposits are on and near the shore of Smith lake, about five miles east of the main line of the Algoma Central railway. A trail leads from near mile 168, but as it starts in a sandy brulé, and much of the country has been burned, it is very difficult to find.

Fig. 21—Granite Dome at contact of Keweenawan, Mica Bay, near Point Mamainse

Fig. 22—Remains of "Elephant" arch near Point Mamainse

The best showing is on the shore of the lake, where there is an exposure of what seems to be solid pyrite about fifteen feet wide, but unfortunately this does not appear to extend inland. The dip of the wall rock varies from 42° to 58°, and it would seem as if by a leaching of the upper part of the vein and a creeping of the adjoining schist the vein is being covered. Such deposits elsewhere are connected with large bodies of ore, and it is desirable that further prospecting should be done here to ascertain the extent of the body.

In addition to this deposit there are two others which might be described as highly pyritiferous schists or low-grade veins. These have been trenched and prospected more carefully than the first deposit, but so far as the writer is aware, no ore body has been found which could be utilized without concentration.

Mamainse

The latter part of August was devoted to an attempt to locate the deposit of uraninite or coracite near Mamainse. The original description of this material occurs in the *American Journal of Science*. It is also described in the Geology of Canada, 1863. The material was said to have been found in a vein about two inches wide on the face of an almost perpendicular cliff at the junction of the trap and syenite. The shore was examined by the writer for some miles to find whether such a vein could be seen, but although many veins were present, in none of them could a trace of any uranium ore be found. The most promising outcrop, considering the description given, was a tremendous dome of granite close to the contact (Fig. 21). This was examined as carefully as possible without rope ladders, but with equal ill-success. The area was prospected earlier in the summer by two men from Port Arthur, and a party from the Geological Survey of Canada arrived the day of the writer's departure.

On the dumps of the old copper mines some material of a yellowish colour was found, but it failed to show any radio-activity.

Certain features of interest in connection with the work of the earlier part of the summer were found in examining some of the traps at Mamainse. At one point a vein of hematite with quartz and siderite was found in the trap near the Elephant Arch. This, however, is only a few inches wide, and is of no economic importance. It is of interest in this connection to mention that this arch (Fig. 22) has disappeared, and no large blocks mark its location. Part of one of the original supports still remains, but the rest of the arch has been completely destroyed.

On two or three of the beaches at the contact between the Laurentian and Keweenawan a large quantity of pebbles consisting chiefly of epidote and orthoclase was observed. Some of these were gathered, and a few have been cut into gems. The material is very attractive in appearance, and although not of great value, might be sold in the form of souvenirs at tourist points along Lake Superior.

In concluding the writer desires to express his appreciation of the courtesy and assistance extended to him by those in charge of mining and prospecting operations. In particular, he would mention Mr. A. Hasselbring, general manager of the Magpie mine, and Mr. G. R. MacLaren, superintendent of the Helen mine, who, by their intimate knowledge of the resources of the region, were able to make the task before the writer less arduous. He would also express his thanks to Professors A. P. Coleman and T. L. Walker for suggestions in the preparation of the report.

Appendix

PHYSICAL PROPERTIES OF KAOLIN FROM THE HELEN MINE

By J. Keele

Two samples of clay from the Helen mine, Michipicoten, were submitted to me for examination by Mr. A. L. Parsons.

These clays are of a type which is exceedingly rare in Canada, being the result of weathering of hard rocks *in situ.*

Sample 273 is a residual clay from the weathering of Keewatin schist. It is of a bright yellow colour, and in a fairly finely divided condition, over 90 per cent. can be washed through a 200-mesh sieve, the residue being chiefly quartz grains, and larger particles of a concretionary character.

When tempered with water the clay develops only a low plasticity, being very short-grained and of poor working quality, so that it is difficult to mould into shape. This clay burns to a porous light red body at low temperature, but becomes denser and gray in colour on burning to higher temperatures. It is vitrified at cone 9 (1310° C). The softening point was not determined, but the material is probably not a fire clay, as the amount of fluxing impurities present, notably the iron, is rather high. It is, however, a fairly refractory clay, and when mixed with a more plastic material may have some value for the manufacture of certain clay products. The uses of such a mixture are given in the discussion on the industrial value of the next sample.

Sample No. 274 is residual from the weathering of a diabase dike. It is of light grey colour, but contains numerous small particles of dark coloured mineral. About 90 per cent. of the clay can be washed through a 200-mesh sieve, the coarse residue appearing to consist mainly of particles of feldspar not completely kaolinized. This clay requires 40 per cent. of water to bring it to the best working consistency. It is very plastic, being more so than most residual clays. Its shrinkage in drying is about 7 per cent. It burns to a light gray porous body, at low temperatures, the test pieces being badly cracked in the fire and the body brittle. When burned to cone 9 (1310° C) the body is hard and dense, and of a light gray colour, with some dark fused specks on the surface. Vitrification is not quite complete at this temperature, as the absorption of the burned body is 3 per cent. The shrinkage is high, the total shrinkage at cone 9 being 20 per cent.

The material was tested for refractoriness in a Hoskins electric furnace, and was found to be intact at the softening point of cone 30 (1730° C). It is therefore a No. 1 fire clay, and by far the most refractory plastic material yet found in Ontario.

The material exhibits all the physical properties of kaolin, except that it does not burn to a white colour. Washing does not improve the colour of the burned body, as most of the dark iron-bearing mineral, which gives the gray tone, is so finely divided that it passes over with the minute clay particles during the washing process.

China clay is the trade name for washed kaolin, and is one of the principal ingredients in all whiteware bodies, such as tableware, electric and sanitary porcelain, floor and wall tiles, etc. It appears to be essential that the washed kaolin shall be free from iron, and white burning, to be of use in these industries.

This clay might be used in some pottery bodies where whiteness is not important, but the fused specks which appear on the surface of the burned clay might interfere with the proper development of the glaze applied to these wares.

The refractory qualities of the clay suggest its use for the manufacture of fire brick. The clay alone could not be used for this purpose, but it might be used as a bond in the manufacture of silica brick.

Some of the Huronian quartzites in this region are very pure and highly refractory. The addition of about 25 per cent. of this kaolin to ground quartzite would probably produce a good silica brick. These bricks would have to be burned at a very high temperature, say 1500° C, to produce a commercial article.

A mixture of two parts of No. 273 with one part of the kaolin produces a very good working raw body, as the latter supplies the plasticity which the residual clay from the Keewatin schist lacks. This mixture burns to a good hard strong body without unduly high fire shrinkage at cone 5 (1230° C), and could probably be used for the manufacture of salt-glazed goods, such as sewer pipe or electric conduits. A fairly refractory brick for use in boiler settings and stove linings could also be made from this mixture.

THE NORTH SHORE OF LAKE HURON

Summary Report on Geology and Mineral Industry

By Cyril W. Knight

INTRODUCTION

The Bureau of Mines having been petitioned by the Thessalon and District Board of Trade to carry on certain geological investigations on the north shore of Lake Huron (Fig. 1), the author of this report was instructed to undertake the work by the Provincial Geologist of Ontario, Willet G. Miller, who spent part of the autumn in the field visiting critical localities.

The author gratefully acknowledges the kindness of Messrs R. W. Leonard and Alex. Longwell who put at his disposal two unpublished reports on the old Bruce copper mines. Members of the Thessalon Board of Trade furnished much information regarding the location of certain ore deposits and roads. The Department is especially indebted to Mr. John McEachern, who supplied particulars regarding copper deposits

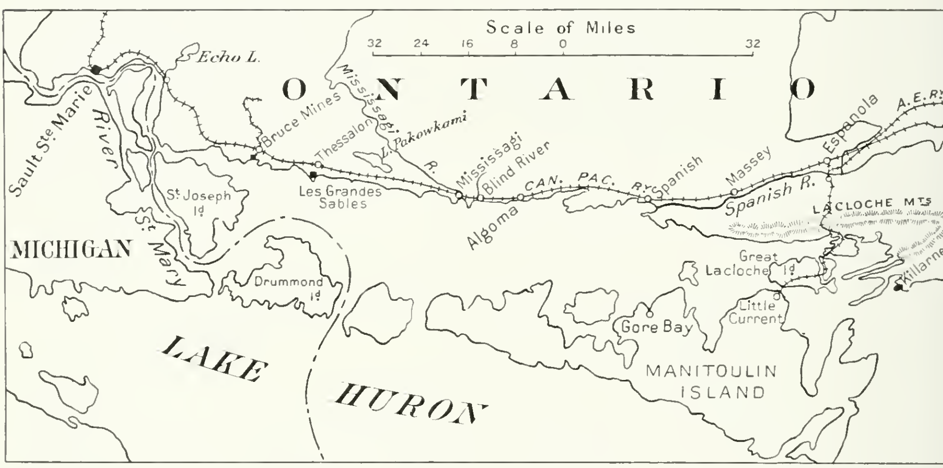

Fig. 1—Sketch map showing location of Bruce Mines and other places on the north shore of Lake Huron

in the township of Gould, and at whose camp cordial hospitality was received. Acknowledgment is also made of the kindness of Mr. J. S. Dobie, who gave the Bureau of Mines the benefit of his accurate, detailed and varied knowledge concerning the topography of the country adjacent to the north shore of Lake Huron. Finally, acknowledgment is due to Mr. W. K. McNeill, Provincial Assayer, who made most of the chemical analyses appearing in the report.

The north shore of Lake Huron has attracted attention of miners and geologists alike since the days when Sir William Logan first expounded the pre-Cambrian geology along its rocky and picturesque coast. The miner was interested in the copper deposits at the village of Bruce Mines, because they produced, according to various estimates, between \$3,300,000 and \$7,000,000 in copper,[1] and the geologist ever thought

[1] The average price of rough copper between the years 1831 and 1880 is shown in the following table. This information has been obtained from the Copper Handbook by W. H. Weed:

Decade	Price per lb
1831 to 1840	20.35 c.
1841 to 1850	17.97 c.
1851 to 1860	24.03 c.
1861 to 1870	18.81 c.
1871 to 1880	17.10 c.

of the territory as classic ground. Strangely enough, however, systematic and detailed revision of this part of the country has been neglected by geologists until the past few years, and a regrettable confusion has thus resulted in the use of the classic term "Huronian."

Although Logan's map of the area between Blind River and Sault Ste. Marie contains many erroneous assumptions regarding the areal extent of the formations, nevertheless his conclusions with reference to the age relations of the rocks have proved to be correct. Logan found, for instance, that the oldest series in the area was a granite complex which he called Laurentian.[2] On the granite rested conglomerates, quartzites and other sediments with great unconformity. These Logan named Huronian. In addition there were certain basic igneous rocks which he found to be in intrusive contact with the Huronian. It may be added with truth that time has but served to confirm the accuracy of these conclusions.

The Bureau of Mines has adopted different names for the rocks which Logan studied. Reasons for this change in nomenclature have been given elsewhere.[3] The granite which Logan called Laurentian is now known as Algoman, and the term Animikean is substituted for the younger rocks included in his Huronian.

AREAS EXAMINED IN 1914

In order to compare the rocks at Cobalt, Gowganda and Timagami with the "original Huronian," a belt of country was selected for mapping, through the heart of the territory included on Logan's map. The area selected is bounded on the north by a great granite region, and on the south by the fringe of granite along the shore of Lake Huron between Thessalon and Blind River. For convenience, this area will be referred to as the Thessalon area. It includes parts of the townships of Morin, Otter, No. 188, No. 182, Gould, Wells, Kirkwood, Thessalon River, Day, Bright additional, Bright and Thompson. The rocks were mapped in a little more detail than could be attempted by Logan and Murray, but not in as great detail as is desirable. The delineation of lines of contact, for instance, is generally approximate and hundreds of diabase dikes were not mapped at all. The map, however, shows the outlines of great masses of diabase which were not shown by the early workers, although their occurrence was often noted here and there by inscribing the word "greenstone" on the old map. The presence of the diabase intrusions may have some economic importance, because similar masses at Cobalt and Gowganda are responsible for the formation of the rich silver deposits at these two localities. As a matter of fact it is already known that cobaltite and native bismuth do occur about 25 miles north of Thessalon in the township of Otter. The map of the Thessalon area, which is now ready for the engravers, will not be issued at present.

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[2]The name Laurentian was here given to granite and gneiss, similar in appearance to the rocks farther east, in the Ottawa valley and elsewhere, to which it had been applied. The Lake Huron "Laurentian," however, was not proved by Logan and his associates to be of the same age as the granite gneiss of the Ottawa valley. In other words, the name Laurentian was applied provisionally to the Lake Huron rocks. Logan supposed, as the following quotation shows, that both the "Laurentian" and later "intrusive" granite were present in considerable volume in the area, but in this he was in error. All the granite and granite gneiss studied by Mr. Knight appear to be intrusive into that part of Logan's "Huronian" that is now known as the Timiskamian.

"The intrusive granite occupies a considerable area on the coast of Lake Huron, south of Lake Pakowkami. It there breaks through and disturbs the gneiss of the Laurentian series, and forms a nucleus from which emanates a complexity of dykes, proceeding to considerable distances. As dykes of a similar character are met with intersecting the rocks of the Huronian [Timiskamian] series, the nucleus in question is supposed to be of the Huronian age, as well as the greenstone dykes which are intersected by it." (Geology of Canada, 1863, p. 58.)

From the foregoing it is seen that it was not Logan's intention to describe the granites that are intrusive into any part of his "Huronian" as Laurentian.—W.G.M.

[3]Ont. Bureau of Mines, Vol. XXII, Part II., pp. 123 et seq., and Geol. Soc. Am., 1914, abstract.

In addition to the Thessalon area, referred to in the preceding paragraph, some attention was paid to two other localities, one at Echo lake, 30 miles to the west, the other at Killarney, 100 miles to the east. The Echo Lake area is in the territory included in Logan's detailed map of the north shore of Lake Huron, while Killarney is many miles to the east of this. (Fig. 1.)

The Animikean sediments and Nipissing diabase in the Thessalon area closely resemble rocks of like age in Cobalt, Gowganda and Timagami.

THE THESSALON AREA

The rocks examined in 1914 in the Thessalon area may be classed according to the following legend, the youngest rocks being shown at the top of the table; it will be noted that the Keewatin, Grenville, Laurentian and Timiskamian series were not found, in so far as the examination proceeded. About 100 miles east of Thessalon, however, the Timiskamian and Algoman are well exposed at Killarney, where the age relation of the two series is excellently shown. The rocks at Killarney are referred to later in this report.

Table showing Age Relations of Rocks in the Thessalon Area

KEWEENAWAN	Diabase dikes. These intrusives intersect the Nipissing diabase.
	Intrusive Contact
	Nipissing diabase, similar to that at Cobalt and Gowganda. It sometimes grades into pink micro-pegmatite.
	Thessalon greenstone. The rock is a fine-grained basalt, sometimes amygdaloidal.
	Intrusive Contact
ANIMIKEAN	(1) Pink quartzite and arkose with thin beds of jasper conglomerate. Similar to Lorrain series at Cobalt.
	(2) Slate-like greywacké, beautifully and thinly bedded.
	(3) Conglomerate, greywacké, slate-like greywacké, quartzite, arkose.
	Great Unconformity
ALGOMAN	Granites, massive and at times gneissoid.

Algoman Granite

The oldest rock in the Thessalon area is granite. On the north shore of Clear lake, in township No. 188, the granite is medium in grain, pink in colour, containing few ferro-magnesian constituents such as mica or hornblende. In places it becomes coarser in grain, when the feldspars have a tendency to become porphyritic. The rock does not show gneissoid structures where it is exposed along the shore and elsewhere, but is is intersected by numerous pink felsite dikes. This granite occurs at the north end of the Thessalon area.

The south part of the Thessalon area consists largely of granite, which, along the shore of Lake Huron presents unexcelled and continuous exposures for study. It was discovered here that the rock does not consist of a single intrusion but of many intrusions, and deserves to be called a granite complex (Fig. 2). On an island south of Dayton railway station the complex was found to consist of rocks of at least five ages. The oldest rocks are fragments of dark, basic gneiss and green schist. These fragments are caught up in an intrusion of coarse, grey granite containing biotite. The grey granite and its included fragments are intersected by pink, medium-grained granite

Fig. 2—Surface of Algoman granites on an Island south of Dayton and east of Thessalon on the north shore of Lake Huron, showing igneous rocks of four ages—A, Fragment of basic gneiss; B, Coarse-grained, grey granite enclosing the fragment of gneiss; C, Pink, medium-grained granite dikes; D, Fine-grained red granite dikes. Granite pegmatites, which are not shown in the photograph, intersect all of the rocks, A, B, C and D

dikes. The fourth intrusion is a fine-grained red granite with few coloured constituents. Finally, it was found that all of the previously mentioned rocks are intruded by coarse-grained granite pegmatites which, however, are uncommon. Beginning with the oldest rock—the basic fragments—the later intrusions become progressively more acidic, ending with granite pegmatite. The inclusions of basic gneiss and schist are innumerable: frequently they are drawn out into bands in the granite, producing a typical banded gneiss. The largest area of the basic material found is about 15 chains in diameter, and around its borders may be seen the mechanism by which the banded gneiss is formed. This area occurs on lot 26 of the township of Thessalon River.

On the Indian Reserve, about six miles east of Thessalon, a large mass of the basic, fine-grained schist enclosed in the granite complex contains a band of grey quartzite 20 feet wide, both schist and quartzite being cut in a complex manner by light-coloured granite dikes. This quartzite may be part of the Keewatin-Grenville iron formation, or part of the Timiskamian series. Other similar inclusions of quartzite were noted elsewhere in the Algoman granite along the shore in this vicinity, and also on Pakowkami lake.

What part, if any, of the granite complex described in the two preceding paragraphs is intrusive into the Timiskamian is not known.

Animikean

The Animikean rocks in the Thessalon area are similar lithologically to rocks of like age in the Cobalt area. They also appear to have suffered about the same degree of metamorphism and are resting for the most part in horizontal or gently inclined positions (Fig. 3). In mapping the areal distribution of the formations it was found that for the scale adopted—two miles to the inch—the three subdivisions which were used at Cobalt could also be applied here. Thus the subdivisions adopted are:—

(1) Pink quartzite and arkose with thin beds of jasper conglomerate. This group is similar to the Lorrain series in the Cobalt area. Thickness 400 feet, plus.

(2) Slate-like greywacké, beautifully and thinly bedded. Thickness 100 feet, plus. This rock is also characteristic of Cobalt.

(3) Conglomerate, greywacké, slate-like greywacké, quartzite and arkose. No estimate of the thickness of this group was made.

Unconformity at Base of Animikean

The basal member of the Animikean resting on the Algoman granite has been seen at four different points, at all of which occurs a coarse conglomerate. The first of these was discovered by R. D. Irving in 1887 on an island four miles east of Thessalon. Later it was studied by Pumpelly and Van Hise[1] who described the conglomerate as follows:—

> The pebbles and boulders instead of being widely separated are packed closely together. Within a very small area, a square yard or square rod, may be found all varieties of the material occurring within the Basement Complex—that is, many phases of crystalline schist, gneiss, granite and granite gneiss. On one of the islands in which the contact was seen the line of separation is perfectly sharp and irregular, bending at one place at an angle of 50 degrees. Also the foliation of the granite gneisses abuts almost at right angles against the line of contact at one place. The contact here, then, has all the characteristics of one of erosive unconformability. Upon the second island, instead of a clear line of contact between the conglomerate and Basement Complex, there is an apparent gradation, the change occurring within 5 or 6 feet. Here the solid granite gneiss is first broken; then in passing upward the angular fragments have moved somewhat; in passing still farther upward they become roundish and are mingled with extraneous material, until a boulder conglomerate is reached which is in every respect like that before described.

[1] U.S. Geol. Sur. Bull. 360, pp. 414-415.

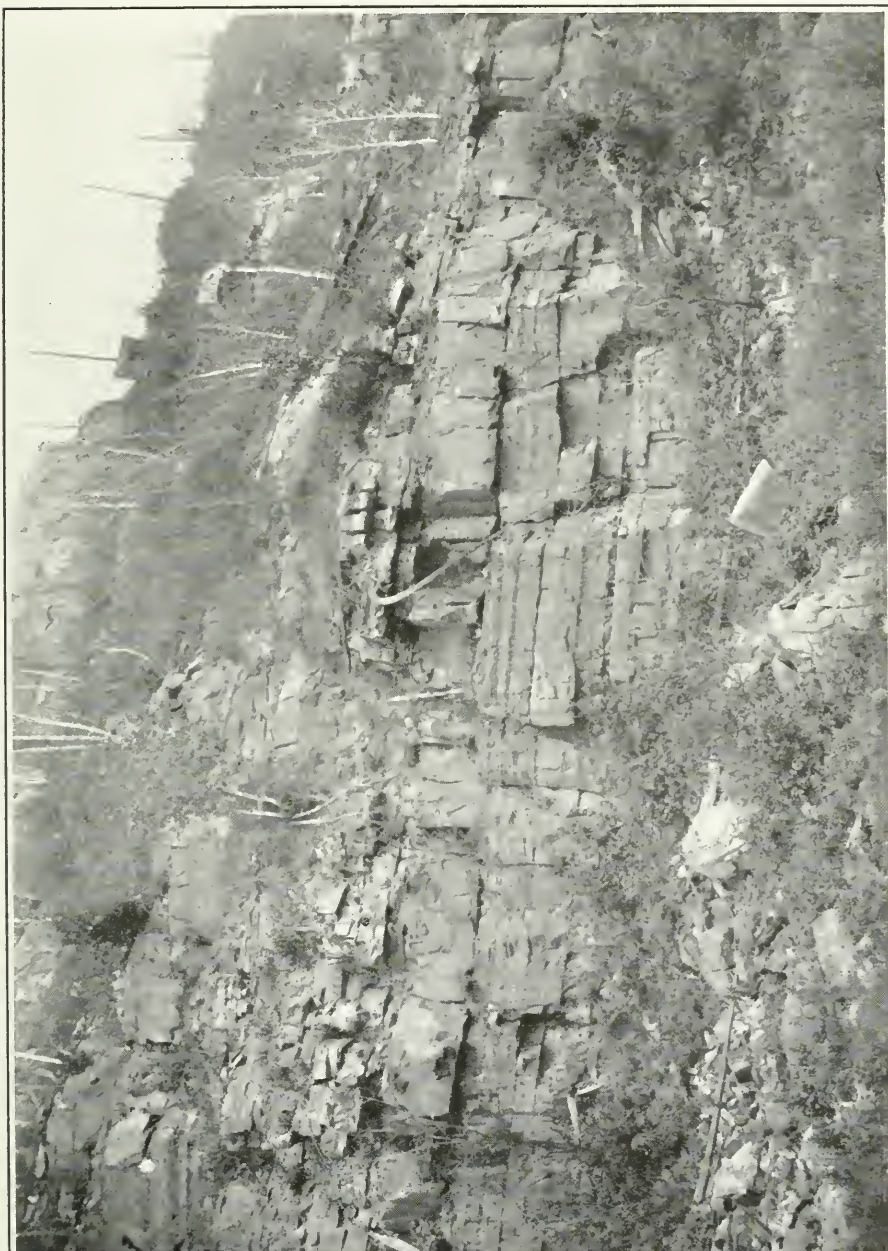


Fig. 3—Gently dipping Animikean sediments in the township of Gould, eighteen miles northeast of Thessalon

The basal conglomerate described above may have a thickness of 100 feet or more on these islands. It passes upwards into grey quartzite, showing beautiful cross-bedding. The quartzite has a thickness of hundreds of feet, and at its top contains a bed a few feet thick of pink arkose, on which rests the Thessalon greenstone (Fig. 4). The thickness of the basal conglomerate is evidently variable, since on the mainland one mile north of the island, on the west side of lot 1, of the township of Thessalon River East, the grey quartzite virtually rests upon the granite, holding a few scattered boulders of it. This is a most striking unconformity. It has not previously been described, and is the second of the four localities at which the unconformity was seen.

The third point at which the basal conglomerate of the Animikean rests on the granite is at the west side of Bass lake, on the point at the narrows, on lot 9 in the third concession of Day township. The conglomerate and granite are separated by six feet of drift, but there is no doubt that, holding, as the conglomerate does, numerous pebbles and boulders of the underlying granite, there is a great unconformity between the two series.

Finally, a fourth contact, making in all three contacts discovered by the author, was found at the north end of the Thessalon area, on the north part of lot one in the sixth concession of Haughton township, 20 miles north of Lake Huron. The conglomerate at the base is coarse in grain containing pebbles 3 to 5 inches in diameter; one pink granite boulder was found having a diameter of four feet. The rock contains a great variety of pink granite fragments and boulders, fine to medium in grain, and massive, although one or two were seen to have a gneissoid texture. Other fragments noted were brilliantly coloured red jasper and medium-grained greenstone. The great unconformity between the granite and sediment is apparent.

Succession of Sediments in Animikean

The conglomerate described in the preceding paragraph is a thick formation, and continues to the east for one and three-quarter miles, when it is succeeded by a beautifully bedded, slate-like greywacké which rests in practically horizontal position. This is group No. 2 referred to in the subdivisions of the Animikean, and has a thickness of 100 feet or more. It occupies the central part of Gould township. The contact between the conglomerate and "slate" is drift-covered. Farther east of this contact, about a mile and a half, the "slate" was observed to pass upwards gradationally into pink arkose and quartzite having a thickness of 400 feet, plus, and containing thin beds of jasper conglomerate. This is group No. 3, and is not only lithologically similar to the Lorrain series at Cobalt but also, like that series, appears to be the highest member of the Animikean.

Judging from what the author saw during the field season of 1914, it is probable that a general succession of formations in the Animikean, applicable to the whole original Huronian area of Logan, cannot be established. The succession varies from locality to locality. It is probable that the history of sedimentation in the Animikean, when it is finally worked out, will prove to be of a complex nature. The known unconformity within the series may add to the complexity. This local unconformity has not yet been detected in the Thessalon area, although present at Echo lake and elsewhere.

The Keweenawan

The Keweenawan series in the Thessalon area is divisible into three igneous groups:—(1) The Thessalon greenstone, which by many authors has been classed as of Keewatin age, (2) the Nipissing diabase, and (3) younger diabase dikes. The diabase dikes intersect groups Nos. 1 and 2. The Thessalon greenstone and Nipissing diabase have not been found in actual contact, and consequently their age relationship is not known. If some of the diabase dikes which intersect the Thessalon greenstone

prove to be Nipissing diabase, then the greenstone will be the oldest of the three groups which compose the Keweenawan. In point of volume the Nipissing diabase is the most important of the three rocks. The Thessalon greenstone has an area of some 15 square miles or more, while the younger diabase dikes occupy a very small area indeed. It may be added that the effusives and intrusives of the Keweenawan of Michigan are also of varying ages.

The Thessalon Greenstone

By far the greater part of the Thessalon greenstone is an uniformly fine-grained basalt lacking amygdaloidal, scoriaceous or agglomeratic facies. The amygdaloidal texture does, however, occur here and there, but it may be said with truth that the agglomeratic and scoriaceous facies are rare. The two latter varieties were found about halfway between Thessalon and Livingstone creek, and again on the southeast quarter of lot 25, east part of the township of Thessalon River. At the latter place the base of the Thessalon greenstone is at one point amygdaloidal and visicular, and this facies rests directly on the underlying, gently dipping Animikean sediments. Pink felsite, showing in some cases amygdaloidal varieties, occurs on Wawa, and other islands, and on the mainland between Thessalon and Livingstone creek. In the short time devoted to its study, it was not ascertained whether the felsite is an acid facies of the Thessalon greenstone or whether it is a younger, intrusive rock. At one locality on the mainland there seemed to be a transition between the felsite and greenstone, while on an island the contact was found to be sharp. The pink felsite is cut by diabase dikes; so also is the Thessalon greenstone. An analysis of the typical greenstone from the southwest quarter of lot 22 of Thessalon River township gave the following results:—

	Per cent.
SiO_2	52.18
FeO	4.14
Fe_2O_3	8.91
Al_2O_3	17.26
CaO	5.83
MgO	3.86
Na_2O	2.86
K_2O	1.76
H_2O	2.56
CO_2	.50
	99.86

The jointing in the greenstone is in places perfectly hexagonal, but it is for the most part irregular. Fig. 5 shows some of the types which were noted. Rarely, if ever, does the jointing approach the appearance of pillow structure characteristic particularly of Keewatin lavas in Ontario.

The age relation of the Thessalon greenstone to the conglomerates, quartzites, and other Animikean sediments is clear and unmistakable. Actual contacts, showing the greenstone in igneous contact with the Animikean, were discovered at three places:—(1) at the mouth of Livingstone creek, four miles east of Thessalon, (2) on the west side of lot 1, east part of the township of Thessalon River at the roadside, and (3) on the southeast quarter of lot 25 in the same township in the valley of Livingstone creek. Of the three localities the last mentioned is the best one to study, and is shown in Fig. 6. The contact is excellently exposed for about 200 feet near the base of a cliff—probably a cliff caused by faulting—which rises steeply above Livingstone creek to a height of some 40 feet (Fig. 6.) The greenstone rests with igneous contact on pink arkose and fine-grained conglomerate showing bedding, and the con-

tact is seen to follow the bedding planes, both bedding planes and contact dipping to the southwest at about 15 degrees. The conglomerate contains pebbles of quartz and granite less than an inch in diameter. For the greater distance along the exposed junction the basalt is massive, but at one point the rock for a few feet is amygdaloidal and visicular, and this variety rests directly on the underlying sediments. The igneous rock at this interesting point has caught up small fragments of the arkose or fine-grained conglomerate.

In addition to these three contacts, which are all at the east side of the greenstone, a fourth was found on the west boundary of the greenstone about a mile north of the town of Thessalon immediately east of the main road. The greenstone is in contact with grey and pink quartzites. The plane of junction dips under the igneous rock at an angle of 60 degrees to the northward. The greenstone is brecciated, possibly owing to faulting, at and near its junction with the quartzites.

Although actual contacts of the Thessalon greenstone and granite were not found, on account of the drift, it is certain that the two rocks do occur in contact with each other at various points.

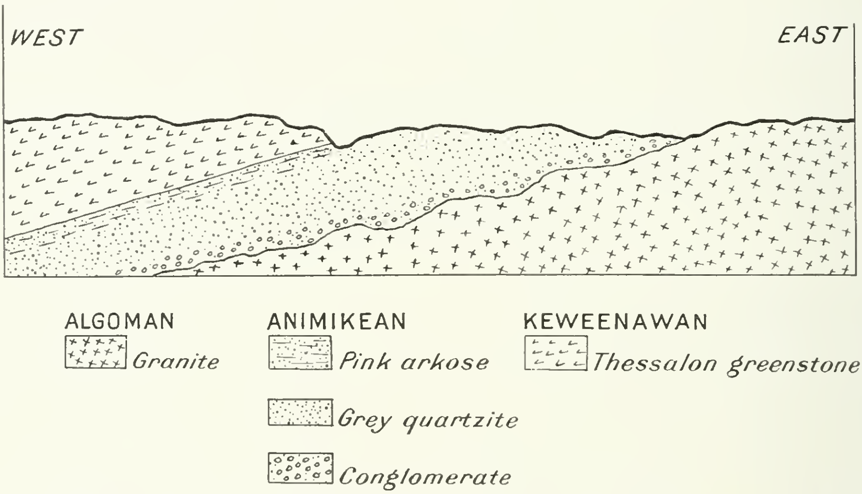


Fig 4—Cross-section, lot 36 in the township of Thessalon River, showing relations of Thessalon greenstone, Animikean sediments and Algoman granite. The figure is not drawn to scale

A cross-section showing the relation of the Thessalon greenstone to the Animikean sediments and Algoman granites is shown in Fig. 4. The conglomerate, holding boulders and pebbles of granite, rests with great unconformity on the granite; this relationship has long been known, having been first described by Sir Wm. Logan. The conglomerate passes gradually upwards into grey quartzite and finally into pink arkose or fine-grained conglomerate, upon which rests the Thessalon greenstone. The grey quartzite, which is beautifully cross-bedded, is the most important member of the sediments. Its thickness is measured in hundreds of feet. At the three contacts discovered on the east side of the greenstone this rock is always resting on the pink arkose and conglomerate; the first and second contacts are about a mile apart; the third lies about a mile and a half to the northeast of the second.

Other cross-sections, if drawn, would show the Thessalon greenstone in igneous contact with the granite, the sediments being absent. It would, therefore, appear that the greenstone cuts its way through sediments and granite alike.

Form of Thessalon Greenstone

It has been pointed out by Sir Archibald Geikie[5] that it may occasionally be a somewhat difficult matter to distinguish between a sill and a subaerial stream of lava,

[5] Text Book of Geology, Fourth Edition, Vol. II., p. 732.

more especially when, owing to extensive denudation, or other cause, only a small portion of the rock can now be seen. In regard to the Thessalon greenstone it may be remarked that on account of the uncommon occurrence of amygdaloidal or visicular textures it is probable that the rock has the form of an intrusive sheet or sill which did not quite reach the surface. Most of the contracts show its sill-like nature (Fig. 6). It is known that sills may have amygdaloidal textures.

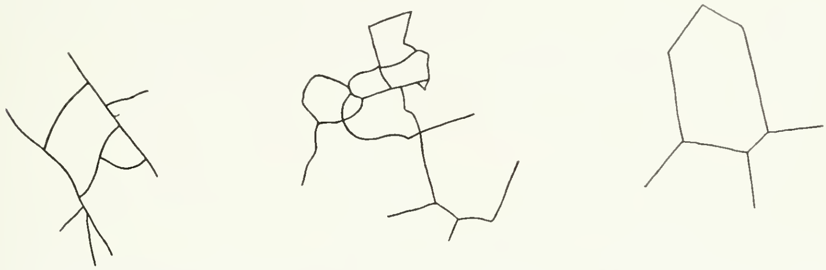


Fig. 5—Examples of jointing in the Thessalon greenstone. The two illustrations on the left side are about 18 inches in their greatest diameter, the remaining figure is four feet

Fig. 6—Thessalon greenstone resting on gently dipping sediments of Animikean age. (See also Fig. 4) The line of contact is shown a little below the centre of the photograph

Nipissing Diabase

The Nipissing diabase, which occurs in dikes and sills, is similar lithologically to the diabase at Cobalt and Gowganda, and, therefore, a detailed description of the rock will not be given in the present report. Besides the diabase facies the rock also shows gabbro varieties. In addition, "pink spots" frequently develop in both varieties consisting of micrographic intergrowths of quartz and feldspar. At times this acidic material may form most of the rock, when it may properly be called micropegmatite or granophyre. Another point of similarity which the diabase in the Thessalon area bears to the diabase of the Gowganda area is found in the presence of aplite dikes occurring in the rock in the township of Day.

The rock is largely developed in the townships of Wells, Day, Bridgland and Kirkwood.

Echo Lake Area

Although about a month was spent in examining the rocks in the vicinity of Echo lake and Echo river, the area will not be described in detail in the present report. It was felt, however, that the unconformity previously known to exist there justified some work being done.

The rocks surrounding Echo lake consist of Animikean sediments and the Nipissing diabase. The sediments are more disturbed and altered than those in the Thessalon area. Their more metamorphosed condition is shown by the presence of folds and faults; one of the faults on the south face of Echo mountain, at the north end of the lake, has rendered the sediments quite schistose. The rocks around the lake dip at angles of about 10 to 45 degrees and more, with an average dip of probably 25 degrees or less.

The succession of formations in the Echo Lake area was believed by the International Committee in 1904 to be as follows:[6]

Upper slate conglomerate
    Unconformity
Limestone
Lower slate conglomerate.
Quartzite

This succession was found to be correct, and a cliff west of Echo lake about half a mile long was discovered in which the contact between the upper slate conglomerate and limestone is splendidly exposed at many places along its entire face. The limestone in the cliff is laminated, and it was found that the contact with the upper slate conglomerate follows the lamination of the limestone. In almost every instance it was discovered that there is a transition between the limestone and the upper conglomerate. A bed of calcareous or dolomitic, porous and rusty-weathering greywacké from one-eighth of an inch to three inches thick rests on the limestone; this is generally followed by greywacké, sometimes more or less calcareous or dolomitic, from one to four feet thick, above which rests typical slate conglomerate. In one instance, however, the conglomerate was separated from the limestone by only two inches of rusty weathering greywacké.

These observations prove that the break or unconformity between the conglomerate and limestone in this area is slight. In no instance, indeed, were the limestone beds observed to be cut across by erosion prior to the deposition of the conglomerate. That there is a break is shown by the presence of large and small fragments of the limestone in the overlying conglomerate. One of these fragments, five inches in diameter, was found a distance of five feet above the limestone. The statement may be made that, were it not for the presence of these limestone fragments in the conglomerate, an unconformity would probably not be suspected. It is concluded that the unconformity is much less in magnitude than it has hitherto been described to be.

[6] Report of International Committee on Lake Superior Geology, Journal of Geology, Feb.-Mar., 1905.

Approximate thicknesses of the sediments at Echo lake and vicinity are: upper slate conglomerate, 60 feet; limestone, 120 feet; lower slate conglomerate, 60 feet; quartzite, 500 feet.

Chemical analyses have proved that the base of the limestone is dolomitic, but that it rapidly passes into limestone containing only small quantities of magnesia.

The table below gives chemical analyses of the limestone at Moose lake, which is about three-quarters of a mile west of Echo lake. Nos. 1, 2, 3 and 4 are from samples one inch, six inches, 12 feet and 20 feet respectively below the top of the limestone bed; No. 5 is a few feet above the base of the limestone. To these analyses is added one from Garden River (No. 6), 10 miles to the west; the sample was taken across the bed a distance of 50 feet at intervals of five feet, this part being near the top of the bed.

Table Showing Analyses of Limestones near Garden River and Echo Lake

—	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
SiO_2	51.70	34.80	29.90	19.68	13.26	21.52
FeO	1.61	0.96	0.52	0.93	0.84	0.32
Fe_2O_3	0.80	0.71	0.34	0.27	0.36	Trace
Al_2O_3	2.65	0.63	0.30	1.51	3.90	2.64
MnO..........	0.31	0.30	....	....	....	....
CaO..........	21.50	34.25	36.00	42.39	25.97	40.75
MgO..........	1.84	0.21	2.12	0.73	16.74	1.21
CO_2	18.82	27.05	30.39	33.78	38.22	33.03
H_2O	0.73	1.05	0.62	0.76	0.83	0.65
	99.96	99.96	100.19	100.05	100.12	100.12

Prominent ridges of Nipissing diabase occur on the east and north sides of Echo lake. A chemical analysis shows that the rock is similar to the Nipissing diabase at Cobalt and elsewhere, and in the field they cannot be distinguished. On the west side of Echo mountain the diabase has a sill-like form, the top of the western part of the mountain being capped by this rock.

A chemical analysis—No. 1.—of the diabase on Echo mountain is given in the table below. For comparative purposes two analyses of the Nipissing diabase at Cobalt are added—Nos. 2 and 3.[7]

[7] Ont. Bureau of Mines, Vol. XIX., Part II., p. 106.

Table Showing Analyses of Nipissing Diabase.

	No. 1.	No. 2	No. 3
SiO_2	48.92	49.84	48.06
FeO	9.32	6.40	9.57
Fe_2O_3	3.81	1.51	
Al_2O_3	14.10	18.94	18.23
CaO	8.69	10.32	11.55
MgO	7.69	7.39	7.80
K_2O	0·89	1.28	0.27
Na_2O	2.77	1.99	1.87
CO_2	0.54	....	....
H_2O	3.05	2.57	3.54
S	0.12	...	....
	99.90	100.24	100.89

It may be mentioned that a fine-grained dike of basalt four inches in width was found cutting the diabase on Echo mountain. A determination of the silica content of this dike gave 50.44 per cent. In addition to this determination an assay was made for platinum and nickel; negative results were obtained.

The Killarney Area

The Timiskamian series consisting largely of white, vitreous quartzite, is exposed near the fishing village of Killarney and to the west for many miles in La Cloche mountains. The village itself is built on the Algoman granite (Fig. 7). At various places the relations of the two series—Algoman and Timiskamian—are clearly demonstrated. Where actual contacts of the two rocks were observed, the granite was seen to intersect the quartzite, and to hold large and small fragments of it. The granite, locally known as the Killarney granite, while presenting an uniformity in its composition, at the same time exhibits a wide range in its texture. It varies in the latter respect from fine-grained, rhyolitic or felsitic varieties to those which are medium in grain. Again it is very coarse-grained, and at times porphyritic, showing pink feldspar phenocrysts half an inch in diameter. It also, at times, has a gneissoid texture. In places the coarse-grained variety intrudes and holds fragments of the rhyolitic facies, but at other contacts the fine-grained type grades into the coarse-grained granite.

On an island about 50 feet long in the innermost part of Killarney bay, the Timiskamian series contains beds of impure limestone one to six inches thick. The beds are contorted and faulted and dip steeply to the east. Thicker beds of limestone are found near the shore in the same bay.

The Timiskamian series in Frazer bay, to the west of Killarney bay, contains a low-grade iron formation interbedded with the quartzite. It consists of ferruignous, slaty material having a thickness of at least 75 feet. In June, 1914, a diamond drill was drilling the deposit and had penetrated a distance of 70 feet. The iron formation strikes northwestward and dips steeply to the northeast.

Faults and Fissures

Everywhere in the Thessalon area the rocks have been disturbed by faults and fissures. The most apparent fissures are those now represented by diabase dikes, of which the number is great. For instance, in a distance of half a mile along the shore of Lake Huron, east of Livingstone creek, six fresh diabase dikes were observed cutting the granite and striking northwestward. They have each a width of about 30 feet. Similar dikes intersect the Animikean sediments. The fissures of this age were probably formed prior to and during the intrusion of the Nipissing diabase, and constituted the channels through which the magma was erupted.

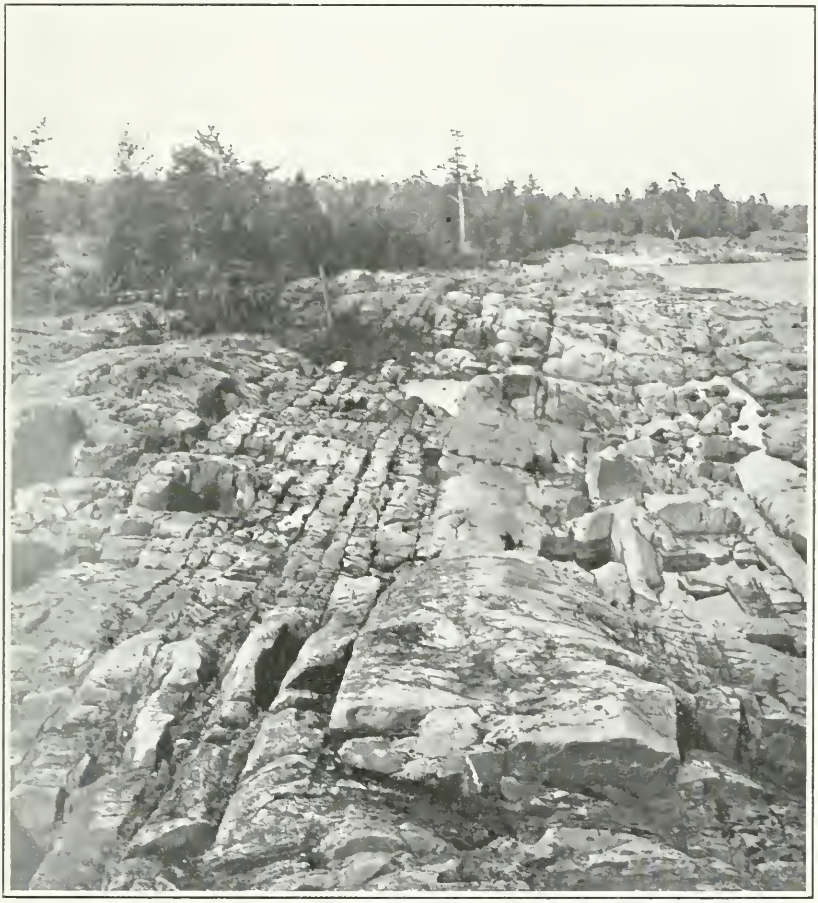


Fig. 7—Joint Planes in Algoman granite at Killarney

A younger and easily recognizable series of fissures is represented by the numerous veins of quartz, which, owing to the presence in them of copper sulphides, from the copper deposits at Bruce Mines and elsewhere. These dislocations intersect the Algoman and Animikean rocks and the Nipissing diabase, and were formed shortly after the cooling and consolidation of the last mentioned rock.

The preceding system of fissures was followed by a third which cut across the quartz veins. These were filled with molten magma and are now readily recognized in the field as dikes. Finally there is proof that some of the striking escarpments, which rise with precipitous faces in many parts of the area, have been caused by

faulting. Particularly on Echo mountain at the north end of Echo lake is the evidence of the faulting unmistakable. This great system of faulting was no respecter of formations. It disturbed alike rocks of Algoman, Animikean and Keweenawan age. Probably the great fault which runs eastward and westward of Pakowkami lake, and which was mentioned by Logan, belongs to this class. Doubtless there are other systems of fissures than the four to which reference is here briefly made.

MINERALS AND MINES ON THE NORTH SHORE OF LAKE HURON

In the autumn of 1914, the only mining operations that were being carried on were at the quartz quarry near Killarney (Fig. 8). Consequently the notes given below must refer almost wholly to properties which were then inactive. Of these, the old Bruce copper mines have had most time and money spent on them. Their importance many years ago is shown by the fact that prior to 1875 they constituted one of the world's great copper mines.

A list of the minerals and other materials which are of interest on the north shore of Lake Huron may be given as follows: copper, gold, silver, cobaltite, native bismuth, quartz, trap rock, marble and building stones.

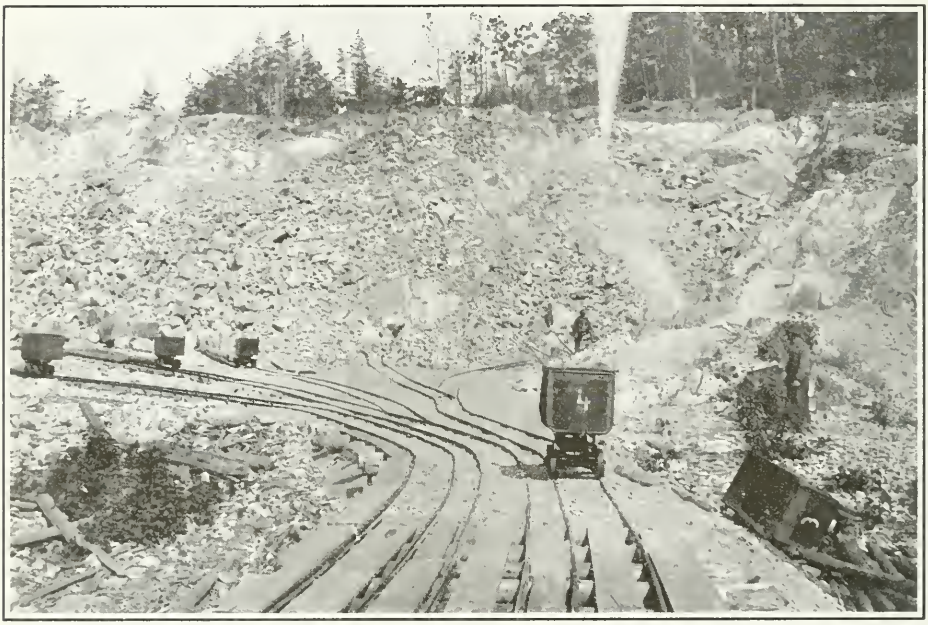


Fig. 8—Quartz quarry near Killarney on the north shore of Lake Huron. The quartz is used for making ferro-silicon

Copper

The most widely known deposits of copper on the north shore of Lake Huron occur at Bruce Mines, about 35 miles east of Sault Ste. Marie. Below will be found a description of the veins and workings. In addition to the Bruce Mines, similar deposits occur at various places in the surrounding area, a few of which were visited. It may be pointed out that these deposits differ radically in their mode of formation from the nickle-copper ore bodies at Sudbury. A. P. Coleman believes that the latter occurrences were formed mainly by magmatic segregation in a basic rock called norite, while the former are quartz veins carrying copper pyrites. These veins vary in size from small stringers to strong veins having a width of 50 feet, but the main vein at Bruce Mines on which most work was done has an average width of about five and a half feet.

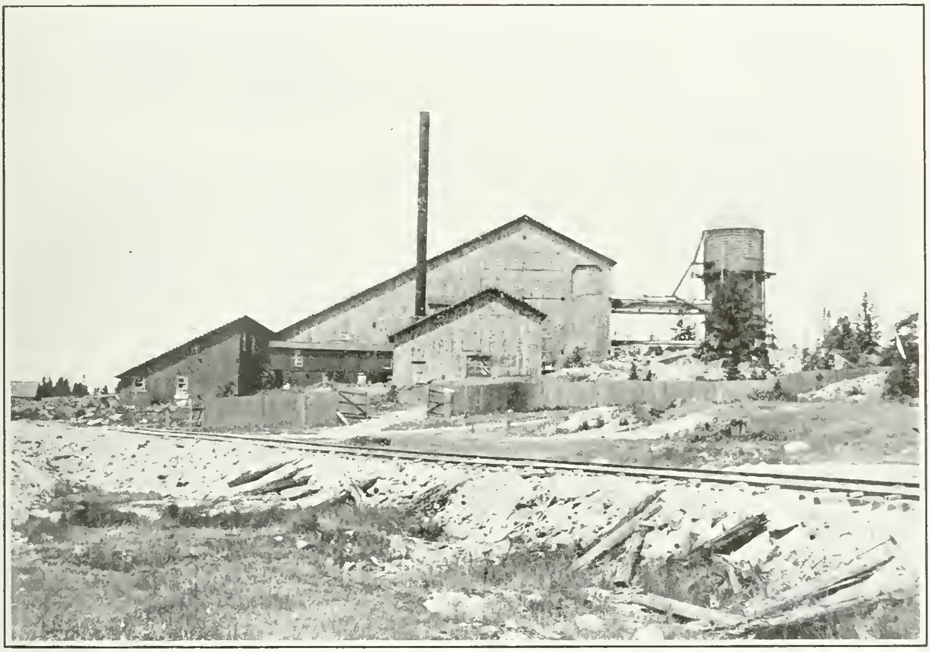
It was found during the examination that the smaller quartz veins contain a higher average per cent. of copper than the larger veins; for instance, a vein 50 feet wide and at least 300 feet long, at Moose lake in the Garden River Indian reserve, does not contain any visible copper ore. On the other hand, certain small deposits in the township of Gould show 12 inches of solid chalcopyrite.

Age and Origin of Veins

The age of the copper deposits is known within narrow limits. The veins intersect the Nipissing diabase and older rocks, and are in turn cut by dikes of later diabase. It would thus appear that they are of about the same age as the cobalt-silver veins at Cobalt.

Regarding their origin, it is probable that they were formed by hot solutions given off during and after the cooling of the Nipissing diabase.

Although they contain, in certain instances, cobaltite and native bismuth in very



Mill at Bruce Mines, on the north shore of Lake Huron

small quantities, there is otherwise little resemblance to the rich cobalt-silver veins in Cobalt and surrounding area. The Animikean sediments and the Nipissing diabase, on the other hand, do present in both regions such remarkable similarities that veins containing native silver and smaltite might be expected to occur in some favoured township. Such an area may not be discovered in the present generation.

The Bruce Copper Mines

The copper deposits in the Bruce Mines area were discovered in the year 1846, and were reported on by Logan in 1848 and later. Prior to 1875 the mine was one of the world's most important copper producers, and there were shipped 47,593 tons of concentrates to England, the average copper contents of which were about 20 per cent. It has been estimated that during this period 400,000 tons of rock were mined, of which 100,000 remain as waste on the dumps and probably 300,000 were treated. No facts are on record regarding the average per cent. of metallic copper which the 300,000 tons of ore

contained, but it has been roughly calculated to be about 4½ per cent. There was considerable loss (40 per cent.) in treating the ore. At times during these operations the property appears to have paid handsome dividends. Nevertheless work ceased in 1876 and the mine lay idle until 1898. Examinations made in that year by new interests are said to have demonstrated that at a depth of 420 feet there is an ore body 18 feet wide with an average copper content of over 3 per cent.[5] However, success did not follow this attempt to work the deposits and, after further work was done in 1906 and 1907, by still another company, the property was sold to Messrs Leonard and Longwell who operated the mine in 1908 and 1909. An account of this work is given by Mr. E. T. Corkill, in the Eighteenth Report of the Ontario Bureau of Mines on page 89. The mine and mill are at present (June, 1915) idle.

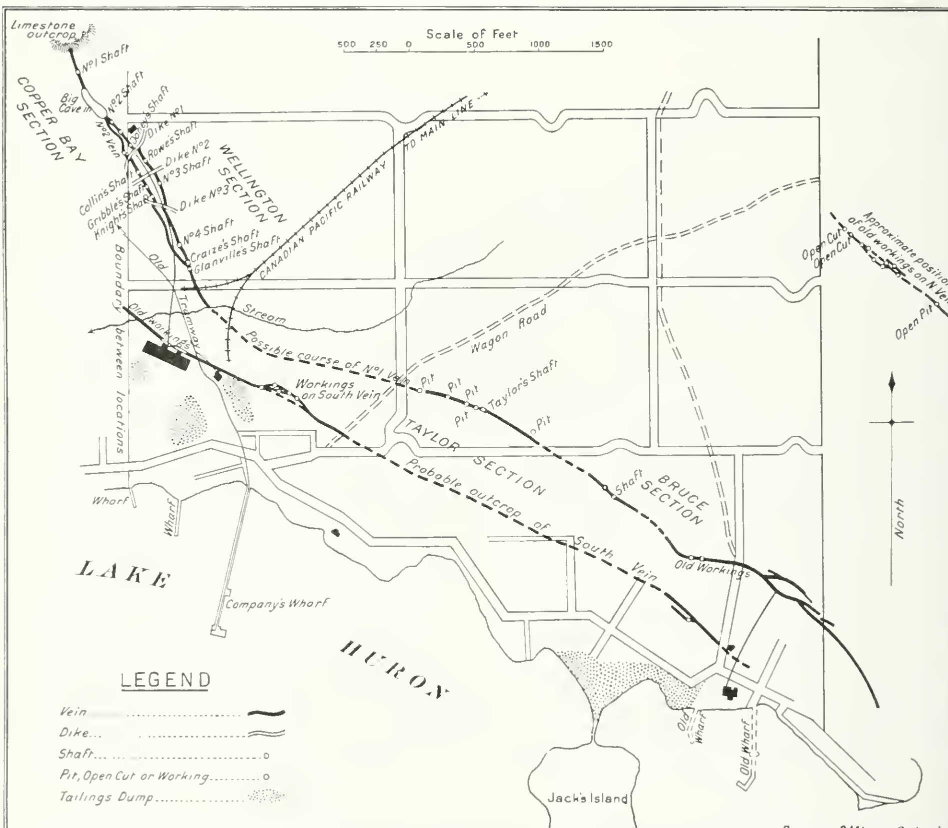


Fig. Plan showing copper veins and workings at the Bruce Mines, on the north shore of Lake Huron

The area in the vicinity of the town of Bruce Mines is divided into four sections, which, beginning with the most westward, are the Copper Bay section, the Wellington section, the Taylor section and the Bruce section (Fig. 9). In the various reports upon the copper deposits these sections are constantly referred to.

The ore bodies occur in the Nipissing diabase, and consist of quartz veins having a vertical dip and a northwest strike. The copper mineral is chalcopyrite and, in addition to the quartz gangue, there are small quantities of calcite and barite. It may be added that the quartz freezes to the walls of the veins, and the walls are fairly well defined.

[5] Jour. Can. Min. Inst., Vol. X., 1907, p. 150.

Fig. 9 shows the number and extent of the veins. The deposit of most economic value is known as No. 1, or the main lode. It has been extensively developed on the Copper Bay and Wellington sections, which are economically the most important in the area under consideration. No. 1 vein appears to be a remarkably long one. On the Copper Bay-Wellington sections it extends in unbroken regularity, except where it is locally disturbed by minor faults and basic dikes, for about 2,000 feet. There is no development for some 2,000 feet between this and the Taylor section to the southeast, but what is supposed to be No. 1 vein is again shown there. Then for about 900 feet there is another blank, after which the vein is exposed in workings with more or less continuity for 2,500 feet through the Bruce section, the location of the original Bruce mine. This makes a total of some 8,000 feet on the strike of the vein. The greatest depth proved by actual sinking is 450 feet[9].

On the Copper Bay and Wellington sections the main vein, where distinct, has an average width of 5.5 feet, and No. 2 vein of 5 feet. These two veins are separated by a horse of country rock, and both are intersected by three basic dikes 20 to 30 feet in width which dip at high angles.

In some instances the dikes have faulted the veins through which they cut, the throw being about 20 feet.

Particularly in the Bruce Mines section, No. 1 vein is characterized by an off-shooting of little veins on each side of the main lode.

The Bruce section was the first to be worked in the area, these old workings occurring at the eastward end of vein No. 1. It was abandoned after the development of the Wellington and Copper Bay sections, which proved of most economic value. Some work was also done from the Taylor shaft, which is about 1,000 feet northwest of the old Bruce mine. From the Taylor shaft to the nearest portion of the Wellington mine the distance is 2,400 feet.

The workings of the Bruce section consist of numerous shafts and openings which extend along the strike of the vein for a distance of 2,300 feet, the ground having been worked at intervals.

In the Taylor section the shaft has been sunk to a depth of 65 feet, from which level drifts have been carried 197 feet to the southeast and 192 feet to the northwest. Above the northwest drift a stope has been started from which 300 to 400 tons of rock have been taken out.

Several shafts were utilized to develop the Wellington section (Figs. 9 and 10). This mine has a length of 1,360 feet and an average depth of 200 feet, and stopes from the No. 1 vein yielded at least 70,000 tons of ore.

The workings in the Copper Bay section (Figs. 9 and 10), have a length of 1,000 feet, and three shafts were sunk, the deepest of which is 450 feet—that being the deepest shaft in the entire area.

The remarks made above concern veins Nos. 1 and 2. The workings upon what is known as the South vein are scattered over a distance of about one mile, and good ore is said to have been extracted from the lode.

The North vein lies northeastward of the old Bruce mine, and little work has been done on it.

The veins were sampled about sixteen years ago. One of the reports consulted shows that the average copper contents of No. 1 vein on the Wellington and Copper Bay sections are about 3.3 per cent. for an average width of 5½ feet and for 1,800 feet along the vein. The same report shows that in the majority of cases the samples give on assay only traces of gold, but it is interesting to know that in a few cases small quantities of gold are present, and that in one or two cases the gold contents were high, amounting in one sample to 2½ oz. per ton. The gold averages 0.3 dwt. for the Wellington section of No. 1 vein.

Another unpublished report, made a year later, shows that the average contents of vein No. 1, in the Copper Bay, Wellington and Taylor sections are 3.8 per cent. of

[9] Ont. Bureau of Mines, Vol. XVIII., p. 89.

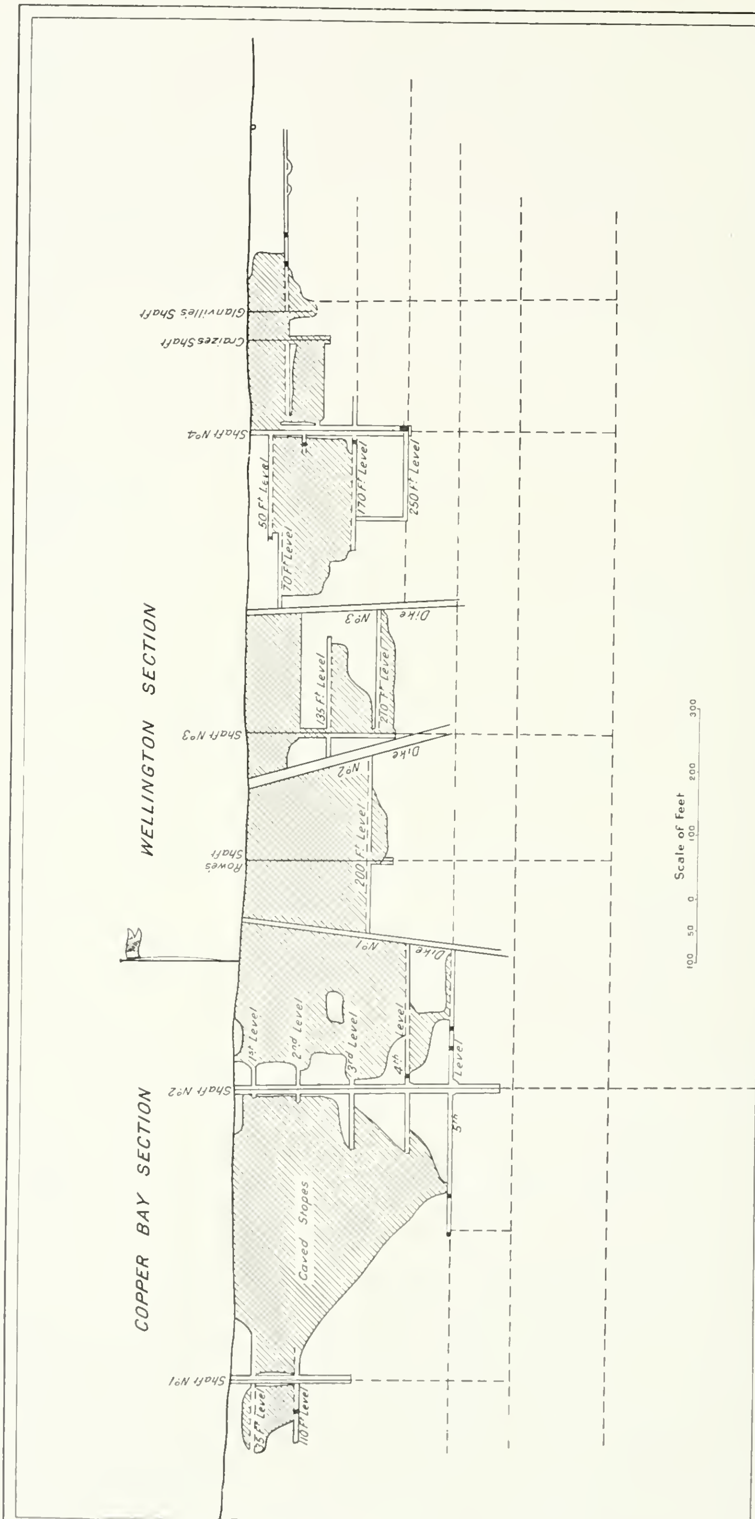


Fig. 10—Longitudinal cross-section, No. 1 vein at the Copper Bay and Wellington sections of the Bruce Mines on the north shore of Lake Huron. The cross-section shows the locations of three dikes which intersect the vein

copper for a width of 5.5 feet. The average contents of vein No. 2 were found to be 2.67 per cent. of copper for a width of 4.12 feet. The average silver contents of the ore were found to be .16 oz.; only traces of gold were detected.

It has already been pointed out that the veins in the Bruce Mines area occur in the Nipissing diabase. If, in the future, the property be worked again, the question will naturally arise: How deep are the quartz veins likely to descend? It is known that the deepest workings are 450 feet.

If the veins are confined entirely to the diabase, then their vertical extent will depend, of course, on the depths of this rock. The thickness of the diabase depends on its form. If, for instance, it occurs in the form of a sill, it will be more shallow than if it occurs as a large dike or boss. The writer has seen no contacts of the diabase with the other rocks in the immediate vicinity of the mines. To the east, however, in the Thessalon area, known contacts are both vertical and horizontal, which would appear to show that the diabase occurs in the form of sills and of dikes. Two hundred miles to the northeast of the Bruce Mines, at Cobalt, it has been proved that the Nipissing diabase is a sill with a thickness at times of about 1,100 feet. Again, at Port Arthur the diabase also occurs as a sill. In these three cases, including that at Bruce Mines, the rock is very similar lithologically, and it bears the same age relations to surrounding rocks.

In the preceding paragraph it is supposed for argument that the veins are confined wholly to the diabase, of which supposition there is no actual proof. On the contrary, it is known that there are many similar veins in the surrounding region which intersect not only conglomerate, quartzite, slate and other sediments, but granite as well. Therefore, it may be that the quartz veins at Bruce Mines extend down through the diabase and into the rocks below, but what really happens will fall to the province of the miner to discover. The writer merely points out the various possibilities.

Other Copper Deposits

To the north of Bruce Mines and Thessalon there are a number of other copper deposits on which work has been done, among which the Rock Lake mine may be mentioned as one of the chief. The quartz veins briefly described in the following paragraphs are of a similar character to the deposits at the Bruce mines.

On lot 12, in the third concession of Gould township, a quartz vein occurs on the north bank of the Mississagi river at Boulder rapids. It contains copper and iron pyrites, hematite and limonite. The vein intersects pink arkose or quartzite of the Animikean, and has about an east and west strike with a dip of 75 degrees to the south.

About three miles to the northeast there are copper prospects on lot 7 and adjacent lots in the fifth concession of Gould township. The shaft at the roadside on lot 7 has been sunk to a depth of about 70 feet; it does not appear to fill with water. An inspection of this shaft shows the deposit to consist of parallel quartz veins from a fraction of an inch to two or three feet or more in width, containing chalcopyrite, siderite and calcite. The deposits occur in conglomerate of Animikean age. The veins have been stripped at a few points to the east for about a quarter of a mile.

To the east of these claims is located a copper prospect owned by the Copper Range Company, on the west part of lot 4 in the fifth concession of Gould township. The occurrence, though small, is one of the richest of the copper deposits examined, and consists of several more or less parallel and irregular veins having a width of from two inches to three feet or more. Some of the veins consist of solid chalcopyrite about 12 inches wide. The veins, which occur in beautifully bedded greywacké slates of the Animikean series, strike southeast with a steep dip to the southwest. A shaft has been sunk to a depth of 45 feet, and a drift run at that level a distance of 45 feet.

The Mississagi river at the north end of Wells township and the south part of Gould township assumes a remarkably straight course in a southeast direction for about five miles. This part of the river valley appears to follow a line of fissuring, and at several places the fissures are filled with quartz and other minerals. The cliffs in the "tunnel" gorge rise vertically in places for a hundred feet, and above they ascend more gently for 100 to 150 feet. The rock along much of this part of the Mississagi is Nipissing diabase, and at and near the quartz veins it is frequently so much decomposed that it is now soft and may be removed with a pick. The quartz in the veins, which vary from a few inches to several feet in width, is mostly of a white colour, but it has at times a beautiful rose-like tint. Other minerals noted were: chalcopyrite, chalcocite, malachite, iron pyrites, specularite, limonite, hematite and cobalt bloom. The mineral from which the cobalt bloom was derived was not discovered, the "bloom" itself being found in small quantities. A little work in small open pits and trenches has been done here and there on the veins.

At Grand falls, near the south end of Gould township, considerable work was done a number of years ago at the Grand Portage mine on a red quartz vein, which intersects the conglomerate and appears to be an extension of the veins which are described in the preceding paragraph. A plant was installed but was subsequently burned; in the ruins may be discerned the remains of a small compressor, a hoist, pump and two drills. The shaft at the property was sunk to a depth of 150 feet.[10]

On lot 6, in the third concession of McMahon township, three townships westward from Gould, a vein of quartz has been exposed for about 300 feet or more by cross-trenches; in addition a 20-foot shaft has been sunk. The occurrence consists really of a system of quartz veins which branch and unite in a most complex manner. Chalcopyrite and pyrite occur very sparingly, but specularite is found in masses one to four inches in diameter. The interesting point about the deposit is that it is intersected by a dike of fresh diabase less than 100 feet in width. The vein occurs in greywacké of Animikean age, containing pebbles and boulders of granite, and both the greywacké and quartz veins are cut by the diabase dike.

In the adjacent township of Morin there is located a copper prospect known as the Copper Queen, on which a shaft has been sunk to a depth of 140 feet.

The Rock Lake copper mine is located 12 miles north of Bruce Mines, in the township of Plummer. In connection with mining operations a railway was built from the town of Bruce Mines to the mine. In addition a great deal of money was spent on the plant. The shaft was sunk to a depth of 420 feet, and the plant included a 200-ton concentrator and a 10-drill Rand air compressor. The ore bodies are very irregular veins or lenses of quartz containing copper pyrites and a little bornite. Some of the stopes are said to be 20 feet wide.

About a mile to the northwest of Echo lake, a quartz vein occurs in greywacké of Animikean age. The vein has a width of six or seven feet, and is located about 300 feet above the lake. An adit at least 75 feet in length has been run, and a shaft of unknown depth sunk. Small quantities of copper pyrites and rusty iron carbonate are disseminated in the quartz.

A copper prospect known as the Canada Verde is located on lot 24 of Rose township, a few hours' drive by horse to the northwest of Thessalon. The deposit is made up of a number of more or less parallel veins of quartz, the whole system, including rock between veins, having a width of six to eight feet. The veins strike to the northwest and have a vertical dip. Chalcopyrite and siderite occur in the quartz. The deposit is found in Animikean greywacké with which are interbedded thin beds of pink quartzite. Nipissing diabase occurs 50 feet to the southwest of the vein, and the

[10] Ont. Bureau of Mines, Vol. VIII., p. 37.

strike of the contact of the diabase and greywacké is parallel to the strike of the vein. Judging from what could be seen on the surface, it appears that the diabase is resting on the greywacké.

The King Edward copper prospect, which is situated about a mile northwest of the Canada Verde, is in Rose township on the south half of lot 11. A quartz vein about 10 feet in width with an east and west strike occurs in a prominent ridge of Nipissing diabase. Chalcopyrite occurs disseminated in the quartz, but part of the vein is barren. The shaft on the property is said to be 50 feet deep.

The Two Lake mine is located on lot 8 in the fourth concession of the township of Day, about nine miles northeast of Thessalon as the crow flies. The size of the orebody could not be ascertained, but on the dump there are some 25 tons of ore showing

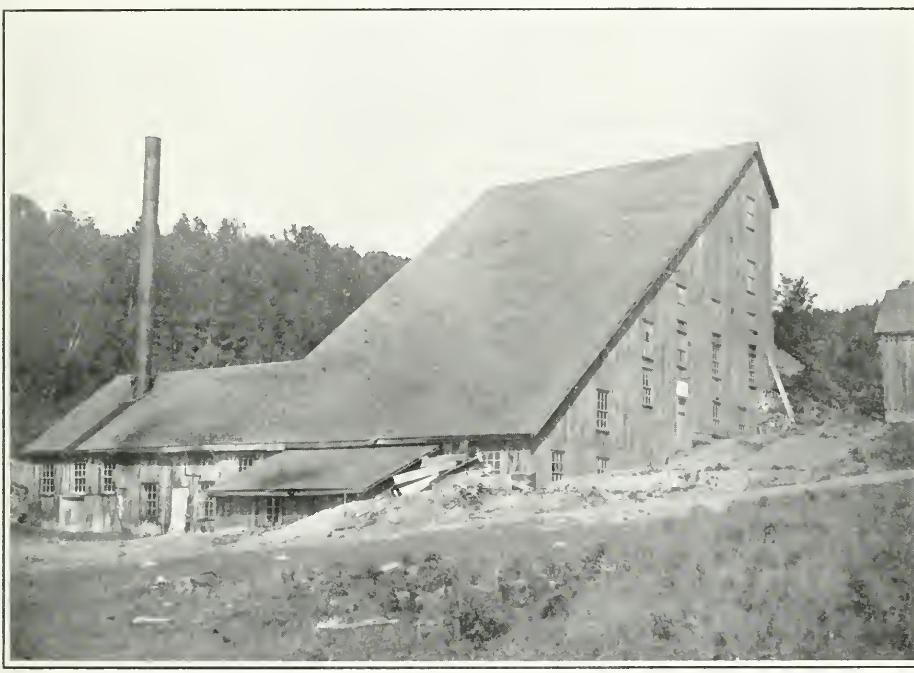


Fig. 11—Mill at Havilah Gold Mine—formerly the Ophir—in the township of Galbraith, 18 miles north of Bruce Mines

chalcopyrite in a gangue of quartz, siderite and calcite. Some of the material is beautifully banded, showing alternate bands of siderite and quartz. The deposit occurs in conglomerate of the Animikean series.

Quartz veins carrying copper pyrites also occur in the vicinity of the village of Desbarats, about 25 miles west of Thessalon.

Gold

Certain of the quartz veins contain, in addition to copper pyrites, some gold. At the Havilah mine, formerly known as the Ophir, a quartz vein was worked some years ago for this precious metal.[11] The property is located north of Bruce Mines, in the township of Galbraith, on lot 12 in the third concession. A quartz vein, carrying copper pyrites, iron pyrites, and siderite, is exposed on the surface showing a width of 12 to

[11] Notes on the Ophir mine are to be found in Vols. II., III., IV., and later reports of the Ontario Bureau of Mines.

15 feet. It occurs in a prominent ridge of Nipissing diabase, and a shaft has been sunk to a depth of 97 feet. There are several buildings and a mill on the property (Fig. 11).

In the description of Bruce Mines given in an earlier part of this report it was shown that gold occurs in the quartz veins but not in economic quantities.

Farther east, to the north of Webbwood, gold occurs at the Shakespeare mine. Still farther east, at Long Lake mine, southwest of Sudbury, gold occurs associated with mispickel. The latter deposit has been described by A. P. Coleman.[12]

Silver

The Victoria argentiferous galena vein is situated some ten miles east of Sault Ste. Marie, and about eight miles north of Garden River. Considerable work has been done on this little known deposit, the shaft having been sunk to a depth of 410 feet, with drifts and cross-cuts at the 50, 100, 150, 210, 237, 265 and 410-ft. levels. The property has been described as follows:[13]

> The vein runs about north-north-west, parallel to the western side of an extensive mass of very fine-grained reddish-grey granite or quartz-feldspar rock, from which it is separated by a few feet of glossy, green schist and tough, green trappean rock, some of the latter approaching the character of an amygdaloid. Work was commenced at the Victoria mine in 1875, and at the time of the writer's visit in 1876, two shafts had been sunk, each to a depth of 15 feet, in the midst of a belt 36 feet thick, of glossy-surfaced, green schist, cleaving in all directions and containing galena in strings, grains and small bunches. One of the shafts followed a vein of solid galena, mixed with considerable dark blende and a little copper and iron pyrites, from 8 to 19 inches thick, and the other a similar vein 10 inches thick, but containing a mixture of quartz. This lead-bearing belt of schist is succeeded on the west by siliceous felsites and dark green and rather coarsely crystalline hornblende-rock, which is again followed by fine-grained, light reddish or pinkish-grey granite. This belt of veins was afterwards worked to a considerable depth, and a large quantity of galena taken out and exported. The proportion of silver varied from a few ounces up to 168 to the ton of 2,000 pounds, most of the ore being tolerably rich. The Cascade mine, a short distance to the northward of the Victoria, is said to be on the same belt and to resemble the latter in most respects.

Assays from shaft No. 2 of the mine showed at 100 feet in depth 13.2 oz. silver and 54 per cent. of lead. At shaft No. 1 results of assays gave at 100 feet in depth 23 oz. of silver and 72 per cent. of lead; at 150 feet 26 oz. of silver and 76 per cent. of lead; at 265 feet 10 oz. silver and 62 per cent. lead; and at 327 feet in depth 29 oz. silver and 54 per cent. of lead.

Cobalt, Native Bismuth and Silver

The occurrence of cobaltite, an ore of cobalt, and native bismuth in Otter township, about 25 miles north of Thessalon, was described by Mr. A. G. Burrows.[14]

On lot one in the fourth concession of the township a vein has been stripped for 230 feet and a pit 13 feet deep has been sunk; the vein in the pit is seven feet wide. The gangue is quartz, but calcite also occurs, and in addition cobaltite and native bismuth in small quantities. A sample consisting mostly of bismuth gave on assay the following results: gold .03 oz., silver 15.9 oz., bismuth 59.5 per cent., cobalt trace. Another quartz vein a foot in diameter occurs on an adjoining claim and also contains cobaltite and native bismuth.

The veins occur in diabase, which Mr. Burrows suggests may correspond to the Nipissing diabase at Cobalt.

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[12] Ont. Bureau of Mines, Vol. XXIII., pp. 218-9.
[13] Mineral Resources of Ont., 1890, p. 29.
[14] Ont. Bureau of Mines, Vol. XIX., Part II., p. 196.

In McMahon township, which is two townships to the west of Otter, cobalt bloom occurs in small quantities on the north half of lot 6 in the second concession. The vein in which it is found has been stripped 125 feet and is very irregular. At its widest point it is five feet across, and consists of eighteen inches of quartz and three and one-half feet of pure white calcite. Cobalt bloom was noted in small quantities, and also copper and iron pyrites. The vein occurs in the Nipissing diabase, and is cut at right angles by a decomposed dike in which mica seems to be the only original constituent remaining. On the northeast corner of the same lot a vein of snow-white calcite two feet in width occurs, cutting the Nipissing diabase, but cobalt bloom was not noted in it. The upper two-thirds of the cliff in which the vein occurs is diabase, which rests in sill-like fashion on pink granite. The vein could not be traced downwards into the granite on account of débris.

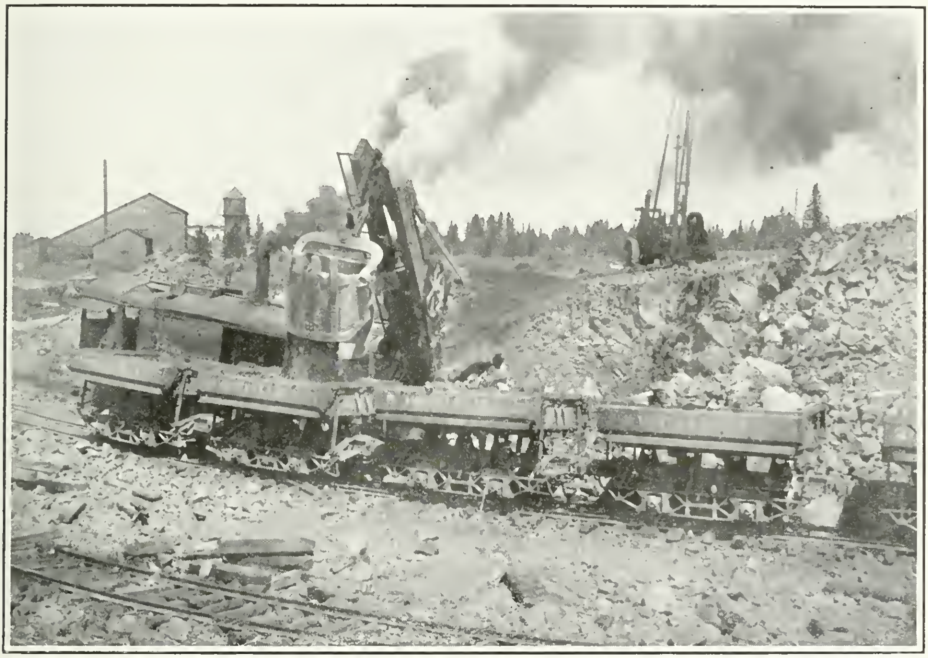

Fig. 13—Steam shovel loading trap rock on cars at the quarry of the Martin International Trap Rock Company, at the town of Bruce Mines, on the north shore of Lake Huron

The third locality in which a cobalt-bearing mineral is known to occur is in the Mississagi valley near the south boundary of Gould township. This has already been described.

Cobalt bloom has been found in the trap, quarried for road purposes, near Bruce Mines and on an island opposite Desbarats.

Quartz

The white quartzite beds of the Timiskamian series are quarried three and one-half miles west of Killarney, in Killarney bay, the material being used for the production of ferro-silicon by the Electro Metals, Limited, at Welland, Ontario. There is an inexhaustible supply of quartz from this source along the north shore of Lake Huron (Fig. 8). The beds quarried are said to contain about 98 per cent. of silica in ship-load lots.

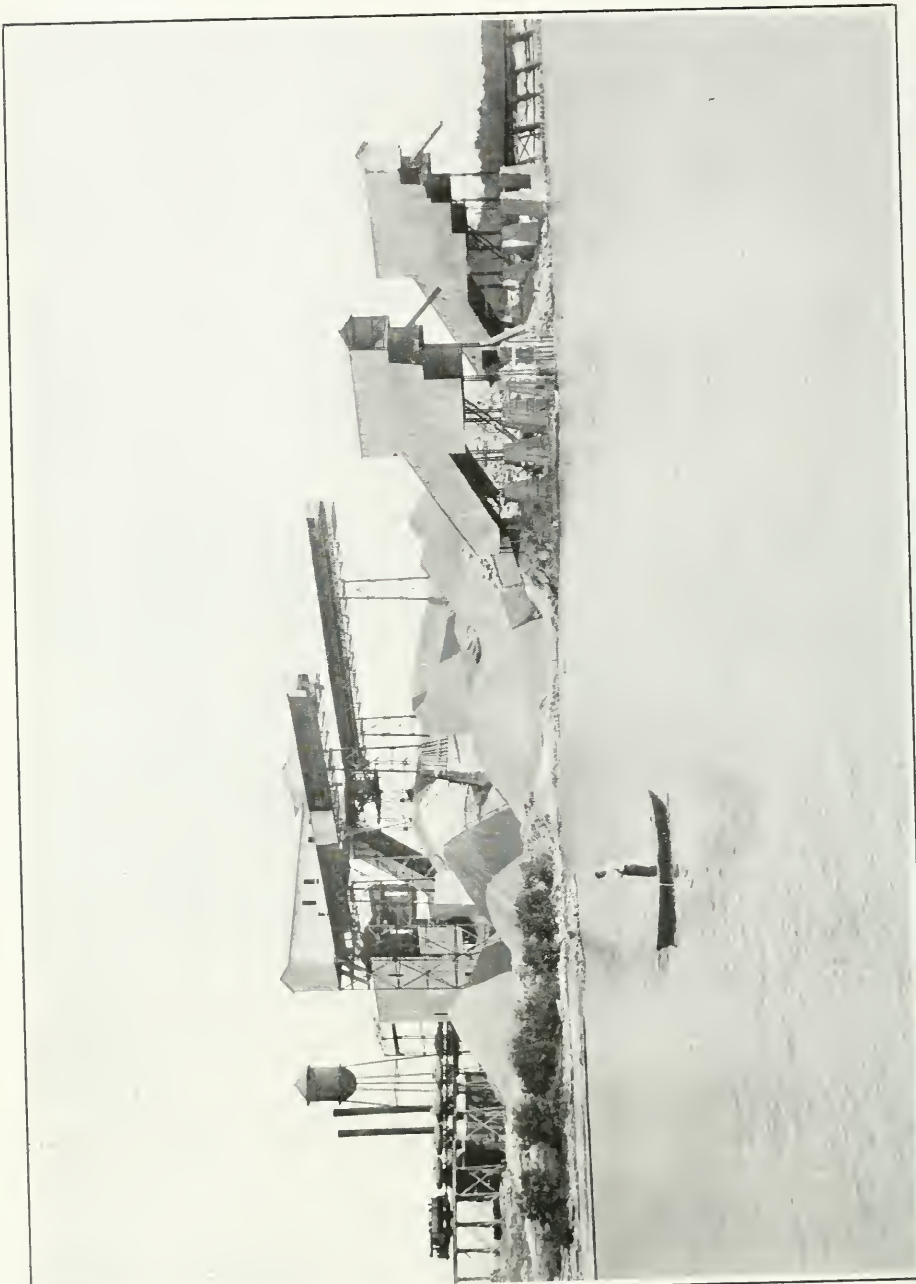

Fig. 12—Plant and stock piles of the Martin International Trap Rock Company at the town of Bruce Mines, on the north shore of Lake Huron. The crushed rock is used in road making

Trap Rock

A large plant (Fig. 12), for crushing trap rock was erected at Bruce Mines in 1913. The rock quarried is the Nipissing diabase, "trap rock" being the trade name; it is used for road-making. The concern, which is known as the Martin International Trap Rock Company, got into financial difficulties in 1914, and ceased operations. The plant has been described by Mr. T. F. Sutherland, chief inspector of mines, as follows:

> The rock is taken from the quarry and hauled in 5-ton cars [Fig. 13] to a 5 by 7-foot jaw crusher, which is said to be the largest crusher in Canada. The rock is discharged from the jaw crusher into No. 9 gyratory crushers, and is fed from there to a series of bucket conveyors. From these it goes to a series of revolving trommels, in which it is sized. The several sizes are taken on belt conveyers to the stock yard. Two concrete tunnels run under the stock yard, and the rock is fed to a belt conveyer which runs in the tunnels; this takes the material directly to the boats. It is estimated that the plant can handle 400 to 600 tons of material per hour.

Both quarry and plant are situated on the shore of Lake Huron, which permits shipments to be made to any port on the Great Lakes. In addition, there is a spur line to the Canadian Pacific railway.

Building Stones

The granite at Killarney, Benjamin island and other localities is of a suitable character for building purposes. It is so situated that the material could be shipped conveniently by water.

At Garden River some work has been done on a bed of light grey marble, and at one time a spur line was built from the Canadian Pacific railway to the quarry, which is distant about a mile from the railway; the track, however, has since been removed. A chemical analysis of the marble is given on page 227.

Geological Sketch Map of Ontario, showing distribution of pre-Cambrian Rocks

METALLOGENETIC EPOCHS IN THE PRE-CAMBRIAN OF ONTARIO[1]

By Willet G. Miller and Cyril W. Knight

Introduction

A few years ago Waldemar Lindgren in an instructive paper gave what he called "an epitome of the principal epochs of the segregation of metals over our continent."[2] He showed that North American "metalliferous deposits have been formed [at various epochs] since the earliest times of geological history." The deposits are grouped by him under the headings pre-Cambrian, Paleozoic, and so forth.

In describing the pre-Cambrian deposits, Lindgren said: "The pre-Cambrian period embraces a very long time and many differing epochs of ore formation; but for our present purposes it will be necessary to consider it as a whole."

During the last decade, owing to the great progress that has been made in the production of metals in Ontario, special facilities have been provided for the study of pre-Cambrian rocks. Our information has been much increased concerning the age relations of the rocks that represent various epochs of this great period, and the ore deposits that are associated with them. It has seemed to the authors that it might now be of interest to present a more detailed classification than that of Lindgren of the pre-Cambrian ore deposits of the Province, showing the various metallogenetic epochs into which the period may be divided. In no other part of the continent, or of the world, has the pre-Cambrian proved to be of greater economic interest, and in no other country are these rocks known to be represented by more important metallogenetic epochs. The variety of metals produced here is greater than elsewhere. The Province has not only the world's greatest deposits of nickel, among which have been developed mines that compare favorably in economic importance with those of any other metals found elsewhere, but the gold mines and the cobalt-silver areas are recognized as being among the greatest of the world.

From the following table it will be seen that there have been at least four great metallogenetic epochs during the pre-Cambrian period in Ontario—Grenville, Algoman, Animikean and Keweenawan. A fifth epoch of minor importance should probably be added to represent the ore bodies associated with the basic intrusives that preceded the intrusion of the Algoman granite and followed the deposition of the Timiskamian sediments. There is proof that many important ore deposits have been removed by erosion, and it seems not unlikely that the rocks of certain epochs, not now productive, contained deposits which have disappeared through the removal of vast thicknesses of material.

Since the authors have given elsewhere an explanation of the nomenclature employed in the table, it is not necessary to deal in this paper with the names applied to the various subdivisions of the pre-Cambrian.[3]

Certain metals may occur in economic quantities in more epochs than the table shows that they do, the authors not having been able to determine definitely the age relations of some deposits.

Age Classification of Ontario Ore Deposits

KEWEENAWAN	Epoch, following basic intrusions, of (*a*) Silver, cobalt, nickel and arsenic at Cobalt and elsewhere, (*b*) Nickel and copper at Sudbury and copper elsewhere. Certain gold deposits, not now productive, appear to belong to this epoch.

[1] A paper presented before the Royal Society of Canada, Section IV., May, 1915.
[2] Jour. Can. Mining Inst., 1909, pp. 102-113.
[3] Ont. Bureau of Mines, Vol. XXII., Part 2, pp. 123 et seq., and Geol. Soc. Am., 1914, abstract.

ANIMIKEAN	Epoch of deposition of "iron formation" as a chemical precipitate.
(ALGOMAN)	Epoch, following granite intrusions, of gold at Porcupine and at many other localities, and of auriferous mispickel. Deposits of galena, zinc blende, fluorite and other minerals also appear to have been derived from the granites, but some of them were not formed till post pre-Cambrian time. Preceding the intrusion of the Algoman granites, basic intrusives, that appear to be of post-Timiskamian age, gave rise to nickel and titaniferous and non-titaniferous magnetite deposits and chromite.
TIMISKAMIAN	Epoch of minor deposition of "iron formation" as a chemical precipitate.
(LAURENTIAN)	Granite intrusions probably gave rise to ore deposits which have been removed by excessive erosion, as is known to be the case with deposits of later origin.
LOGANIAN	
Grenville	Epoch of deposition of extensive "iron formation" as a chemical precipitate among other sediments.
Keewatin	Composed largely of basic volcanic rocks.

Sequence of Intrusion and Metal Deposition

The table brings out an interesting alternation of intrusion and sedimentation, and the importance of the igneous rocks in the formation of ore deposits. It will be seen that there are broadly five great epochs of igneous activity, basic and acid rocks alternating, viz., (1) Keewatin, basic; (2) Laurentian, acidic; (3) pre-Algoman, basic; (4) Algoman, acidic; (5) Keweenawan, basic, passing in places into a considerable volume of acidic varieties. The pre-Algoman basic rocks are of greater volume and wider extent than they are usually recognized to be, since they are frequently wrongly classed as Keewatin. These basic rocks are represented by the sudburite of the Sudbury area, by the lamprophyres of Cobalt and elsewhere, and apparently by the basic rocks of the townships of Dundonald, Reaume and others where associated with them are nickeliferous pyrrhotite and chromite.

Owing to erosion, the sequence of metal deposition shown in the table is doubtless incomplete. Iron formation occurs in three epochs, the Loganian, Animikean and Timiskamian, but is of economic importance only in the former two. Certain deposits of titaniferous and non-titaniferous magnetites, not now being worked, are associated with basic intrusives that appear to be of pre-Algoman age. Arsenic occurs in two epochs, and has been produced in economic quantities from the rocks of both. In so far as is known, gold occurs in economic quantity only in the Algoman, although small quantities are obtained in refining the copper-nickel ores, and certain auriferous quartz deposits, not now productive, appear to be genetically connected with Keweenawan intrusives. Nickel, as has been shown in the preceding table, was deposited in economic quantities in two epochs. Cobalt, silver and copper are produced only from deposits of Keweenawan age. Platinum, palladium, mercury and other metals are found in small quantities with Keweenawan ores. Zinc and lead have been mined in the Province, but the age relations of some of the deposits are in doubt.

The Keweenawan

The basic rocks that are classed as of Keweenawan age are found in numerous localities as dikes, sills and flows over a vast region in that part of the protaxis occupied by Ontario, Michigan and adjoining territory; in so far as can be determined at

present these rocks are also found far to the northeast in the former territory of Ungava, now part of Quebec, and to the far northwest in the Coppermine River basin and northward to the Arctic coast.

In Michigan and in the Coppermine River country these basic intrusives and extrusives are considered to be genetically connected with deposits of native copper. In Ontario, along the north shore of Lake Huron, the Keweenawan intrusives appear to have given rise to the deposits of copper pyrites, while at Sudbury the copper-nickel ores and at Cobalt the silver-cobalt veins have been shown to be genetically connected with them.

While it is not the intention in this paper to go into detailed descriptions, there are a few facts relating to the ores that are genetically connected with the Keweenawan basic intrusives that should be emphasized, viz.:

(1) They contain the greatest known quantities of the two magnetic metals, cobalt and nickel, and a high percentage of the third element, iron.

(2) The deposits are widespread. In the region surrounding Cobalt, silver-cobalt veins are found here and there over an area at least 5,000 square miles in extent. Beyond this region cobalt ores are associated with these rocks in the township of Otter, north of Lake Huron, and in small quantities along the shore of the lake opposite Desbarats. Similar ores have been found in Michipicoten island in Lake Superior and in the area tributary to Port Arthur, 500 miles distant from Cobalt. With the effusive rocks of Michipicoten island is also found native copper under conditions similar to those of Michigan and the Coppermine River region.

(3) Some of these ores, those of Sudbury, are considered to be a direct segregation from the magma, while the cobalt-silver deposits are less direct, having been deposited from aqueous solutions, although a few veins partake to some extent of the character of deposits formed by segregation from a molten magma.

The Animikean

Interbedded with the Animikean clastic sediments are vast quantities of iron formation, a chemical deposit. Through the action of aqueous solutions concentration of the iron has taken place, giving rise to ore bodies of economic importance.

While the iron deposits of Ontario in the Animikie series of the north shore of Lake Superior have not proved to be of much economic value, across the international boundary in Minnesota they are represented by the great Mesabi ore bodies.

The Algoman

Gold deposits, that are found in numerous localities in the Province, from the Quebec boundary on the east to that of Manitoba on the west, are, in many cases at least, genetically connected with granites to which the name Algoman is applied. In a few cases the granites are represented by more basic rocks. The gold occurs in quartz veins, being associated usually with iron pyrites, but occasionally the ore carries considerable arsenical pyrites or mispickel. Certain of these veins have been worked as a source of arsenic. There are thus two epochs in which arsenic has been deposited in economic quantities, the Algoman and the Keweenawan, represented by the cobalt-silver arsenical ores of Cobalt.

The gold deposits are found chiefly in Keewatin schists, but a few occur in Timiskamian clastic rocks. It is worthy of note that the only gold deposits of the Province that have been proved to be of great economic importance are found in, or in the vicinity of, these Timiskamian fragmental rocks.

Most of the gold, at least in the important deposits, belongs to a later generation than the mass of the veins, having been deposited after the veins were disturbed and fractured.

Basic intrusives that appear to immediately precede the Algoman granite are genetically connected with important nickeliferous pyrrhotite deposits in the township of Dundonald, and with small deposits of chromite and pyrrhotite that have not proved

to be of economic value, in the township of Reaume. These intrusives have not been definitely proved to be later in age than the Timiskamian sediments, but they appear to be so. If this is their age, they correspond chronologically with the lamprophyre dikes of Cobalt and elsewhere, and with the sudburite of Sudbury. Basic rocks genetically connected with titaniferous and certain non-titaniferous magnetites appear to be of the same age.

As in the case of arsenic, there are thus two epochs of nickel deposition in Ontario, the Keweenawan and that described in the preceding paragraph.

Basic rocks contemporaneous with sudburite are more widespread in the Province than they are generally recognized to be, as they have frequently been classed as of Keewatin age. No age name has been applied to these rocks.

The Timiskamian

No ore deposits are known to have been formed during Timiskamian times in Ontario. It may be added that on the United States side of Lake Superior rocks that appear to be of Timiskamian age contain extensive deposits of iron formation, with which are associated ore bodies of commercial importance.

Erosion has removed by far the greater part of the Timiskamian rocks that once were widespread in Ontario, and it is possible that ore deposits of this epoch have also been destroyed.

The Laurentian

No ore bodies that are genetically connected with Laurentian granite and gneiss are known to occur in the Province, but as rocks of this epoch that are now exposed at the surface represent originally deep-seated material, from above which thousands of feet have been eroded, it is impossible to say that ore bodies of Laurentian age have not been destroyed.

The Grenville and Keewatin

Iron formation, representing chiefly chemical deposits laid down during Keewatin-Grenville times is widely distributed. In fact, it may be said that there is scarcely a locality in the Province where Keewatin rocks are found from which iron formation is absent. The iron formation usually consists of interbanded silica and iron ore, magnetite or hematite, but at times there is considerable siderite or iron carbonate. Through the action of aqueous solutions on the iron formation, workable deposits of ore have been produced at various localities.

Erosion of Ore Deposits

Nearly all the ore deposits of the Province have been subjected to excessive erosion. The few exceptions that are known are represented by so-called " blind " veins, i.e., those that do not come to the present surface, such as a small number of silver veins at Cobalt.

While it is not possible to determine the total amount of erosion to which the pre-Cambrian surface has been subjected during various epochs, since the Keewatin-Grenville rocks appeared above the surface of the primeval ocean, it can be proved to be enormous.

In pre-Timiskamian times the Keewatin-Grenville rocks were eroded to a great depth, as is shown by the thickness of the Timiskamian sediments, and the deep-seated Laurentian was exposed at the surface.

Again, in the epoch that gave rise to the Animikean sediments, erosion of all the older series was excessive and long continued. The folded Timiskamian fragmental rocks were cut down until they were represented merely by comparatively narrow belts in certain localities, while over large areas no remnant of them remained. During

this epoch the Keewatin, Grenville and Laurentian again were subjected to great erosion. In post-Animikean and pre-Paleozoic times there was a great erosion epoch. This is shown, for instance, by the outliers of the Cobalt series, and the intrusives that penetrated it.

Since Paleozoic times there has been again much erosion, and Cambrian, Silurian and Devonian strata have been removed over vast areas, exposing the underlying pre-Cambrian.

That many ore deposits of various ages have been destroyed during the several epochs of erosion is evident. Two or three hundred feet more of erosion would have left comparatively little, for example, of the Cobalt silver deposits, of which doubtless more has been eroded than has been mined, or of the great Mesabi iron deposits of Minnesota.

In considering the relation of ore deposits to erosion in the pre-Cambrian of Ontario, it appears that workable ore deposits are confined to limits comparatively near the surface of the earth.

Complete erosion of certain series of rocks, it would seem, may account for the absence of ore deposits in some countries where the pre-Cambrian, although occurring in considerable volume, is barren. For instance, in the northwest Highlands of Scotland there is evidence that fragmental series, probably corresponding to the Timiskamian and Animikean of Ontario, were completely eroded before the deposition of the Torridonian which is considered to represent the Ontario Keweenawan. If we except the Moine or Eastern schists, the age relations of which are doubtful, the rocks now remaining in the Scottish pre-Cambrian appear to represent the Keewatin and Grenville, with the deeply eroded roots of intrusives, and the Keweenawan. If all the sedimentary series that lie between the Keewatin-Grenville and the Keweenawan had been removed by erosion in Ontario, there would be nothing left of the ore bodies that are now found enclosed in Timiskamian and Animikean rocks, or in the intrusives associated with them, and the deposits of whatever age enclosed in the Keewatin and Grenville would also have largely disappeared.

Faulting and folding have preserved parts of ore bodies that otherwise would have been completely destroyed by erosion. This is well illustrated by the Cobalt Lake fault, where silver veins have been protected on the down-throw side of the fault. Had it not been for this fault, and others associated with it, practically all the ore that has been mined in the vicinity of the fault and to the west of it would have been removed. Folding at Kirkland lake and Porcupine has preserved comparatively narrow synclinal belts of Timiskamian sediments and the weathered Keewatin rocks that immediately underlie them, and at one time formed the surface of the earth. There is no reason for believing that erosion has been less in the two localities mentioned than elsewhere in the pre-Cambrian, but probably the character of the rocks, all of which were at one time, before folding took place, subjected to surface influences, has a bearing on the formation of openings and the deposition of ores. The gold deposits are found both in the Timiskamian sediments and in the Keewatin, the more schistose and more highly altered varieties of the latter group appearing to be the more important from the economic point of view.

Relative Economic Importance of Various Epochs

The following table gives the value of the metallic production of Ontario for the year 1913, classified according to age and origin. Considerable nickel, cobalt and arsenic in the Cobalt ores are not represented in the table, nothing being received for them by the mines. A comparatively small quantity of the nickel and copper in the table should be credited to the deposit in Dundonald township that is associated with the basic eruptives of pre-Algoman and probably post-Timiskamian age.

It should be understood that the ages given for the deposits do not refer to secondary concentration, as, for instance, in the case of iron ores, but to the epoch in which the metals were first deposited.

Metal Production, 1913

KEWEENAWAN	
Silver	$16,987,377
Copper	3,952,522
Nickel	14,903,032
Cobalt	525,028
Cobalt and Nickel, mixed	90,266
Arsenic	101,463
	$36,559,688
ANIMIKEAN	
Iron ore	Nil
ALGOMAN	
Gold	$4,543,690
TIMISKAMIAN	
Iron ore	Nil
LAURENTIAN	
	Nil
KEEWATIN-GRENVILLE	
Iron ore	237,976
Iron, pig	957,174
	$1,195,150

While at present there is no production of iron ore from deposits of Animikean or Timiskamian age in Ontario, millions of tons are mined from deposits of these epochs in the State of Michigan.

INDEX VOL. XXIV., PART I

TWENTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO BUREAU OF MINES, 1915,

BEING

VOL. XXIV., PART II.

Records of Wells Drilled

FOR

Oil and Gas in Ontario

Compiled and Edited with an Introduction

By

CYRIL W. KNIGHT

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SKETCH MAPS.

Fig. 1—Map of the Province of Ontario showing the distribution of Paleozoic and Pre-Cambrian rocks. Oil and gas occur in the Paleozoic formations, of which the productive fields lie in the south part of the Province. The great Paleozoic region adjacent to Hudson and James bays has not been prospected for oil or gas.

OIL AND GAS IN ONTARIO

By Cyril W. Knight

Introduction

From time to time in the past the Bureau of Mines has received many enquiries regarding records of wells drilled in the Province of Ontario for oil and gas. These records are scattered through reports of the Geological Survey of Canada, the Ontario Bureau of Mines, the Canadian Mining Institute and other publications. To meet the demand for such information it was thought that a compilation of published and unpublished logs would serve a useful purpose. This is the reason for the publication of the present brief report on oil and gas. It may be added that the report is strictly one of compilation, and that the compiler lays claim to little original field work. The reports of T. W. Gibson, W. G. Miller, G. R. Mickle, E. T. Corkill, Eugene Coste, W. A. Parks, W. A. Johnston, H. P. H. Brumell, C. R. Stauffer, M. Y. Williams, T. Nattress and others have been drawn on freely. In addition, the Bureau of Mines is particularly indebted to the Geological Survey of Canada which, through W. Malcolm, has kindly furnished many unpublished records of wells. Numerous companies and individuals have also supplied useful information concerning their drilling operations.

Of the 407,262 square miles comprising the Province some 30 per cent. are underlain by rocks of Paleozoic age, the remaining 70 per cent. by pre-Cambrian, Fig. 1. Over half of the surface area of the Paleozoic lies in the northern part of the Province adjacent to the flat-lying coasts of Hudson and James bays, and the remainder occupies the region in the vicinity of Lakes Huron, Erie and Ontario. There is also a comparatively small Paleozoic area near the junction of the Ottawa and St. Lawrence rivers. The northern Paleozoic region is virgin ground in so far as prospecting for oil and gas is concerned.

Oil and gas do not occur in economic quantities in the granites, gneisses, quartzites and other rocks of the pre-Cambrian. Hence when the driller passes through the Paleozoic sediments and encounters the pre-Cambrian he invariably, if he is well advised, ceases drilling.

The important oil and natural gas wells of the Province are confined to the Paleozoic rocks of the Erie-Huron, or what is sometimes called the western, peninsula, which latter is defined as that part of the country west and southwest of a line between Georgian Bay and Toronto. The geology of the Paleozoic is discussed elsewhere in the report, but it may be pointed out that wells which have been drilled show that these almost flat-lying undisturbed sediments have a thickness of nearly 3,800 feet in Lambton county, and that their thickness decreases as the pre-Cambrian rocks to the north are approached. No reliable estimate can be made regarding the thickness of the Paleozoic adjacent to Hudson and James bays.

The logs of some of the wells drilled in the Province are given on pages 21 to 89. Owing partly to the manner in which the logs were recorded by the drillers and partly to the changes in nomenclature of various formations in recent years, the names may not correspond with the names of formations given in the legend on page 4. The logs will be found, however, none the less of use to the practical driller. Those records marked with an asterisk have been kindly furnished by the Canadian Geological Survey.

Origin of Oil and Gas

It is not considered necessary in this report to discuss the origin of oil and gas. There is much literature on the subject.[1] It will suffice to state briefly that the majority of geologists believe that petroleum and natural gas are derived from the decomposition of animals or plants. This is known as the organic theory. A few workers, notably Eugene Coste, consider that petroleum owes its origin to emanations from volcanic rocks. This is known as the inorganic theory.

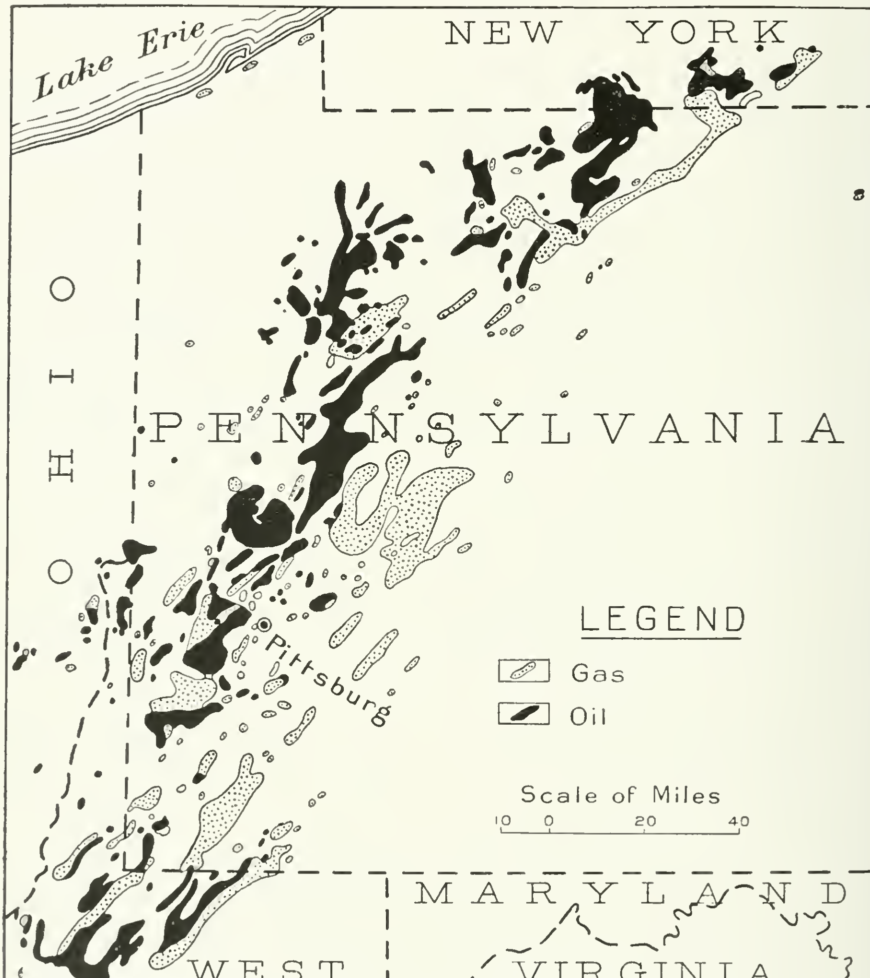

Fig. 2—Map illustrating shape of oil and gas pools in the region south of Lake Erie. Black areas are oil fields, dotted areas are gas fields.

Formation of Oil and Gas Pools

The two main conditions necessary for the accumulation of oil and gas in economic quantities are (1) a porous sandstone, limestone or other rock, and (2) impervious strata of shale, or other material, capping the porous reservoir to prevent the escape of the oil or gas.

[1] The origin of oil and gas is dealt with fully in a paper by Eugene Coste, and discussions thereon, in Vol. XXI, 1911-1912, of the Institution of Mining and Metallurgy.

The porosity or vacant space of an ordinary sandstone is from 8 to 10 per cent., but there may be a rapid change in the same strata from dense rocks, almost impervious to oil and gas, to loose, porous sand. Some sandstones are uniform over large areas. In others the size of the individual grains varies, as does also the amount of the cementing material, both these conditions causing variations in porosity. Sandstones may pass into conglomerates, which, if loosely cemented, may be more porous than sandstones.

The pores or vacant spaces are filled with varying amounts of water. In the Appalachian field, for instance, the lowest strata seem almost dry, but, as higher members are approached, they become more and more saturated.

If oil and gas are present in a dry porous rock, the oil may descend and collect at the bottom, or near the bottom, of synclines. In a porous rock saturated with water, however, the oil and gas are forced to rise on account of the differences in specific gravity. When saturated strata are gently folded into anticlines, the gas may be found at the top of the anticlines, the oil on the flanks, and the water in the basins or sides. The occurrence of oil or gas in anticlines is known as the anticlinal theory. In rocks partly saturated with water, the oil may collect at any point on an anticline or syncline.

Regarding the accumulation of gas, it may be said that under all conditions it will most probably be found in the anticlines.

The irregular outlines of oil and gas pools are illustrated in the great fields south of Lake Erie, Fig. 2.

Geology and Physical Features of the Western Peninsula

The following descriptions of the geology and physical features of the western peninsula have been selected from reports by W. A. Parks, W. A. Johnston, C. R. Stauffer, and others. The two following paragraphs are quotations from a report by Parks.[2] The legend below is compiled from work by Parks and Stauffer.

The portion of southern Ontario which lies west of a line from Georgian Bay to Toronto is known as the western peninsula. The whole of this region is embraced in the coastal plain of Paleozoic age, which was laid down on the western flank of the continental pre-Cambrian protaxis. The area is divided into two physiographic units by a more or less abrupt escarpment (Niagara cuesta) which extends from Queenston, on the Niagara river, to Hamilton at the head of Lake Ontario and thence into the Bruce peninsula between Lake Huron and Georgian Bay. East of this escarpment lies the Paleozoic lowland of eastern Ontario, which, therefore, extends only a short distance into the western peninsula and appears as a narrow belt along its eastern side. The western and much greater portion of the peninsula constitutes an upland with an average elevation above the eastern lowland of 300 feet.

The Paleozoic pre-Cambrian contact extends across the Province of Ontario from near Kingston to the head of Georgian Bay. Northward from these points it is hidden under the waters of Lake Huron except for its occasional appearance on some of the islands along the east side of Georgian Bay and on the islands between Manitoulin and the north shore of Lake Huron. The formations exposed in this district are indicated in the following table:

[2] Guide Book No. 5, Int. Geol. Congress, 1913, pp. 39-41.

		Approximate thickness in feet.[3]
Devonian	Portage and Chemung	20—50
	Genesee	185±
	Hamilton	300+
	Marcellus	10—30
	Onondaga	100±
	Oriskany	0—25
Silurian	Monroe	690±
	Salina	950+
	Guelph, Niagara	275±
	Clinton	0—32
	Medina	0—57
	Cataract [4]	51—126
Ordovician	Richmond	285±
	Lorraine	190±
	Eden	175±
	Utica	50—55
	Collingwood	25±
	Trenton, Black River, Lowville	550—705

Ordovician

The deeper seated members of the Ordovician—Trenton, Black River and Lowville—may be studied on some of the islands north of Manitoulin island, and also in the Lake Simcoe area. In the latter they have an estimated maximum thickness of 550 feet, of which 440 feet belong to the Trenton, and 110 feet to the Black River and Lowville. Well borings in other parts of the Province, where the sections are complete, show that the Trenton, Black River and Lowville group have a combined thickness of about 600 feet. The Black River and Lowville have been carefully described by W. A. Johnston, who points out that the Lowville limestone is sometimes included in the Black River as a sub-formation. Johnson's description of the Black River-Lowville in the Lake Simcoe country is given in the following paragraph:[5]

The base of the series consists of a few feet of coarse, calcareous sandstone or arkose which rest unconformably on the pre-Cambrian crystalline rocks. These beds pass upward into red and green shales, with intercalated lenses or thin beds of sandstone, and occasionally thin beds of fine-grained, dove-coloured limestone. The thickness of the series varies, and the beds are frequently absent on the sides and tops of ridges or domes of the crystalline rocks, where the limestones are seen to rest directly on the old floor. The sandstone and shales are best developed in basins

[3] The following information regarding the thickness of strata in the Province is given by Eugene Coste in the 15th Report of the Ontario Bureau of Mines, page 115:

Dolomites and marls of the Onondaga	1,000 to 1,600 feet with some thick beds of rock salt in places.
Dolomites and limestones of the Guelph, Niagara and Clinton	275 to 375 feet.
Shales of the Medina, Hudson River and Utica	750 to 1,050 feet.
Trenton limestone	600 to 700 feet.
Calciferous sandstone	30 to 50 feet.

In the Niagara district there is a considerable thinning of the Onondaga, but also a great thickening of the shales as follows:

Onondaga	400 feet.
Guelph, Niagara, Clinton	300 feet.
Medina, Hudson River, Utica	1,550 to 1,850 feet.
Trenton	660 to 690 feet.

[4] E. O. Ulrich is of opinion that the Cataract formation should be included in the Medina, or at least in the "Medinian."

[5] Guide Book No. 5, Int. Geol. Cong., 1913, pp. 33-34.

between ridges of the crystalline rocks, where they occasionally have a maximum thickness of about 40 feet. The red and green shales pass upward into impure magnesian limestones, which on fresh fracture are greenish grey in colour and weather yellowish brown. They are characterized by numbers of drusy cavities, occasional quartz grains and crystals of pyrite or limonite, and are generally barren of fossils. They are only a few feet in thickness and are followed by 6 to 10 feet of fossiliferous blue-grey to dove-coloured limestone. These beds somewhat resemble in physical character the typical fine-grained "Birdseye" limestone, but are less compact in texture and weather to a shaly mass. They are overlain by 7 to 10 feet of unfossiliferous magnesian limestone very similar to the beds which immediately underlie them.

Then follow about 20 feet of fine-grained, even-bedded, dove-coloured limestone. The Lowville limestone, which is sometimes included in the Black River as a subformation, is well developed in south central Ontario, and is remarkable for its constant lithological and faunal character, not only throughout this district, but as far as Kentucky, Tennessee and Alabama on the south.

In the vicinity of the town of Collingwood the remaining members of the Ordovician may be studied. These formations, with their thickness, are given below:

	Feet.
Richmond (Queenston) red and green shales	235
Richmond (Queenston) grey shales and limestone	50
Lorraine shales and arenaceous limestone	190
Eden shales	175
Utica shales (Upper Utica)	50-55
Collingwood shales (Lower Utica)	25

In addition to the above a minor thickness of the upper part of the Trenton is also exposed on the shore line a short distance west of Collingwood. These formations have been described in Guide Book No. 5 in the following paragraph.[6]

Collingwood formation.—Resting directly on the Trenton limestones is a series of thin-bedded limestones and dark bituminous shales. Raymond considers that this series of limestones and shales lies below the typical Utica of New York and has proposed the name "Collingwood" for the formation. Utica formation.—Overlying the Collingwood formation is a series of shales of a somewhat less bituminous character which is correlated with the typical Utica of New York. Eden formation.—At Craigleith the Eden shales are exposed directly above the Utica. Lorraine formation.—The Lorraine shales are not actually exposed at this point, but the fossils characteristic of the formation may be obtained from the talus. Richmond formation.—The grey Richmond shales and limestones are not exposed in the section at Craigleith, but they show to better advantage on the road between Mair's Mills and Banks. The fossils are practically the same as those from the Richmond exposure at the Clay Cliffs, Manitoulin Island. The red and green shales of the Richmond are not well exposed, but fossils characteristic of the formation are common in the talus derived from this member. This fact is of great stratigraphic importance, as farther south the member is entirely unfossiliferous and has been ascribed to the Medina.

Silurian

The Niagara escarpment between Queenston, Hamilton and Georgian Bay presents magnificent exposures suitable for the study of the lower half of the Silurian series. The upper part of the Ordovician is also exposed, particularly at the north end of the escarpment. The table below, showing the formations and their thickness at several points along the escarpment, has been compiled by W. A. Parks. It shows that the base of the Silurian series is the Cataract sandstone, which has a maximum thickness of 25 feet and rests on the top member of the Ordovician, i.e., the Richmond or Queenston shales. It should be noted, however, that E. O. Ulrich places the Ordovician-Silurian boundary at the base of the Richmond.[7]

[6] Guide Book No. 5, Int. Geol. Cong., 1913, pp. 100-104.
[7] Rep. Int. Geol. Cong., 1913, pp. 593-667.

System	Formation	Beds	Niagara	Grimsby	Stony Creek	Hamilton	Ancaster	Credit Forks	Collingwood
Silurian	Niagara	Lockport dolomite, cherts, etc.	150	12	13	22	......	30	75
		Rochester shale	68	45	25	15	12	00	00
	Clinton	Limestones and shales	32	14	13	12	12	00	00
	Medina	Grey band sandstone	7½	25	14	12	11	00	00
		Red sandstone							
	Cataract	Shales and limestone	26	74	79	80	??	95	55
		Sandstone	25	6	6	10	??	16½	00
Ordovician	Richmond (Queenston)	Red shales of great thickness, extending far below the section, except at Collingwood.							

A general description of these formations is given by Parks[8] in the following paragraphs:

The Queenston [Richmond] formation consists essentially of red shales with an occasional green band. This formation is unfossiliferous in the Niagara and Hamilton sections, but in the Collingwood section, a distinct Richmond (Ordovician) fauna is revealed. It has therefore become necessary to separate the Queenston shale from the Medina formation in which it has long been included. The overlying grey sandstone (Whirlpool sandstone of Grabau) has hitherto been regarded as Medina, but it is now proposed to consider it as the basal member of a new formation—the Cataract—which represents an invasion from the north and west at the commencement of Silurian time. The upper limestones and shales of this formation are highly fossiliferous and present a fauna comparable with that of the Brassfield formation of Ohio and Kentucky.

In the Credit region, this basal sandstone has been confused with the upper or true Medina sandstone of the Niagara gorge; in consequence, the shales and limestones overlying it have been erroneously ascribed to the Clinton.

All the strata exposed in the Niagara gorge continue as far as Grimsby and even to Hamilton, but at the latter place the Rochester shale, the Clinton and Medina have become greatly reduced in thickness. At Credit Forks these formations have disappeared entirely and the Cataract formation has increased correspondingly. At Collingwood the Cataract formation is again decidedly thinner and presents a different petrographic aspect, consisting of limestone with some shale at the top.

The gradual decrease of thickness in the Rochester, Clinton and Medina strata, and the increase in the Cataract in passing northward is indicated in the table.

The remaining formations of the Silurian, i.e. Guelph, Salina and Monroe, have been described by M. Y. Williams in the following paragraphs:[9]

Guelph formation.—The Guelph is entirely composed of dolomite which varies from buff-coloured and fine-grained to light grey or white, coarsely crystalline and porous rock. It is generally brownish and somewhat bituminous at the base, the bedding varying in thickness from a few inches to several feet, with an average of about 1 foot. Near Hagersville, the formation, as indicated by bore holes, is about 185 feet thick.

The Guelph formation has its most typical development in Ontario and outcrops over a large area, the centre line of which falls approximately through a point about 6 miles south of Hamilton, westward and northward, through Galt, Guelph, Fergus, Waldemar, east of Durham and through Allenford and Chiefs point on Lake Huron. The width of the area of outcrops varies from 2 to 3 miles in the Hamilton region, to 4 miles at Guelph, 16 miles at Fergus, 20 miles at Durham, and 3 or 4 miles at Allenford. At Chiefs point an area of Guelph extends east for more than 12 miles. Northward up the west side of the Bruce peninsula, irregular, more or less isolated areas of Guelph occur north of Wiarton, south and north of Pikes bay, and north of Stokes bay to Tobermory, including the western two-thirds of that part of the peninsula.

[8] Guide Book No. 4, Int. Geol. Cong., 1913, p. 128.
[9] Summary Rep. Geol. Sur. Can., 1914, pp. 83-85.

From the Hamilton area east, the Guelph is poorly defined at the available outcrops, which occur only along Twentymile creek and the Niagara escarpment. Practically no fossils occur in the upper beds to help in their identification, but on lithological grounds, the dark, bituminous dolomites found along Twentymile creek above thin beds, are considered Guelph. At the Niagara river, the New York State Geological Survey places certain beds above the falls in the Guelph. In New York state two horizons of Guelph fossils have been reported with Lockport fossils between.

The Guelph dolomites are very similar lithologically to much of the underlying Lockport formation, and at many localities they are identified only after prolonged investigation. They, however, rest conformably upon thin, dark coloured, argillaceous dolomites which form the top of the Lockport. These are bituminous at many localities and in places have a decided slaty appearance. Dolomites above such beds may safely be considered as Guelph. Besides the position of the Guelph formation, there occur in it a number of characteristic fossils. Unfortunately these are not evenly distributed and are in many cases very fragmentary. In the Bruce peninsula, rock outcrops are large and very numerous. Elsewhere Guelph exposures are generally small, and occur mainly in the stream valleys.

Salina formation.—The Salina formation, which contains at various places lenticular deposits of salt and gypsum, consists of soft grey dolomites, soft, green shales, interbedded with gypsum, and firm slate-grey shales which break into irregular pieces. Where salt is present, it is interbedded with marls and dolomites containing some anhydrite or gypsum.

The Salina formation rests on the Guelph, but on account of the ease with which it is weathered down, the contact is everywhere obscured. The lowest beds appear to be light grey dolomites. The Salina is overlain by the waterlime beds, known near Niagara as the Bertie dolomite, and in the west as the division of the Lower Monroe. In the vicinity of Hagersville, the Salina is about 300 feet thick as indicated by well borings, and at Goderich it is more than 950 feet in thickness as indicated by the salt wells. The thickness of the Salina is very variable, as indicated by well records from different parts of the country. The formation outcrops at Caledonia, Paris, and Cayuga, and may be represented by the lower beds exposed along the Saugeen river between Ayton and Neustadt. Although the actual outcrops are limited, a large area of country extending westerly from the Guelph area is underlain by this formation.

Monroe formation.—The highest Silurian strata of Ontario, according to previous writers, are included in the Monroe formation. This is of variable character, but is well represented in the Amherstburg region by the following section: a lower division of about 260 feet of dolomites containing some chert and thin sandstones; a middle division of pure white sandstone 75 feet thick; and an upper division of 135 feet of dolomites overlain by 39 feet of very pure limestone, known as the Anderdon limestone. The dolomites are in general of a light buff colour and occur in beds from 1 to 2 or more feet thick. The Anderdon limestone is light grey or bluish grey, the beds averaging 2 to 5 feet in thickness.

Except for the quarries in the Anderdon limestone, the Livingstone channel, excavated in the bed of the Detroit river by the United States Government (much of the material from which is piled above water level), the Detroit salt shaft sunk many years ago, and some islands in Lake Erie, the Monroe formation in the Amherstburg region is known only from well records. Because of the similarity in the general character of the Monroe dolomites and those of the Salina formation upon which they rest, it is difficult to say definitely where the boundary between the two formations lies. Minor divisions have been made in the Monroe, but in the present discussion they will not be considered.

The top of the Anderdon limestone at the Amherstburg quarry shows peculiar channellings and cavities filled with sand, and is generally overlain by a thin covering of sand which is mingled with the base of the overlying Onondaga or Dundee limestone. These indications of erosion and rapid sedimentation are altogether lacking at the Sibley quarry of Michigan, where the Dundee rests upon a horizon of limestone not more than 2 to 3 feet higher than the top of the Anderdon in the Amherstburg quarry. The Anderdon limestone and the beds cut in the Livingstone channel carry considerable faunas, which include both Silurian and Devonian types.

The Bertie dolomite exposed in the vicinity of Buffalo, near Hagersville, and on the Saugeen river between Paisley and Glen Eden, has been correlated by Grabau with the Put-in-bay dolomites of the Lower Monroe. The Bertie is generally less than 50 feet thick, and consists of rather thin-bedded, grey or buff coloured dolomites, commonly having bituminous partings. In the township of Bertie, 4 or more feet of thin-bedded, bituminous shales occur near the top. Some of the dolomite beds were formerly used for waterlime and contain the fossil *Eurypterus remipes*. At one horizon, the dolomite has been found by the writer to contain some small brachiopods.

As with the Monroe formation farther west, it is not possible from evidence obtained from borings to say definitely where the boundary between the Salina and the Bertie strata should be drawn. The Bertie dolomite is overlain unconformably by Oriskany sandstone or, where this is absent, by Onondaga limestone.

Devonian

The contact between the Devonian and Silurian, which shows slight unconformable relations, is thus described in the vicinity of Hagersville by C. R. Stauffer:[10]

The Silurian-Devonian contact is uneven and the rocks underneath often show the effects of pre-Devonian weathering. The Devonian often begins with a basal conglomerate composed of subangular and rounded pebbles of the Silurian dolomites mingled with sand, the whole cemented into a solid mass. The thickness of this conglomerate is rarely more than six inches to one foot and it is frequently absent. Where found it usually grades into the overlying deposits without a break. Southeast of Hagersville these overlying deposits are beds of true Oriskany sandstone. At most other places they belong to the Onondaga limestone. The Oriskany is usually composed of moderately coarse-grained quartz sand but is often much coarser and sometimes even pebbly, the individual grains of which are as much as an inch in diameter. Some parts of the rock are so closely cemented by silica that it resembles a quartzite in appearance. The rock is usually massive and sometimes the entire formation appears as a single bed. The total thickness of the Oriskany sandstone rarely exceeds 20 feet, and much less is the usual rule. Although a large part of the deposit is almost barren, fossils are often abundant and in a good state of preservation, even the spires of certain brachiopods and the finest external markings being preserved.

Where the true Oriskany sandstone is absent, there is sometimes found a deposit of several feet of chert, which has been assigned to the same formation as the sandstone. However, the fossils so far found in it are so rare and fragmentary, that its true age is somewhat in question.

Stauffer's description of the Devonian formations is given in the following paragraphs:[11]

Oriskany Sandstone. The Oriskany sandstone is the lowest true Devonian formation in Ontario. It consists of heavily bedded, coarse-grained, white to yellowish sandstone lying unconformably on the Silurian. In places absent, in others it varies in thickness from paper thin to 25 feet and carries the pure Oriskany fauna unmingled with later forms. Evidences of this formation exist from Fort Erie westward nearly to Hagersville, but the arenaceous deposits and scattered bodies of infiltrated sand found beyond that point cannot be definitely assigned to the same formation.

Onondaga Limestone.[12] This is the "Corniferous" limestone of the older reports. The name "Corniferous" refers to the cherty (flinty) character of the rock and was applied, in New York state, to the deposits which later proved to be a portion of the same formation that had previously been called Onondaga limestone. It seems better, therefore, to adopt the correct term in this work, and especially since it is more appropriate to the Canadian deposits. The Onondaga limestone is probably the most variable of all the Devonian deposits of the Province. The basal portion, which rests unconformably on either the Oriskany sandstone or beds of greater age, is often conglomeratic. This conglomerate is made up of pebbles derived from the underlying limestone, and mingled with them are sometimes considerable quantities of sand. This latter may have been derived from the destruction of areas of Oriskany sandstone during the advance of the Onondaga sea. In the vicinity of Springvale this sand becomes so abundant as to locally form a deposit resembling the true Oriskany sandstone, but is much younger in age, as evidenced by its Onondaga fauna. In the eastern and extreme northern outcrops the lower 30 feet or more of the Onondaga is a thin, unevenly bedded, cherty, grey limestone carrying a fauna composed largely of brachiopods. Overlying this is 15 feet, more or less, of a relatively pure, thick bedded crystalline, grey limestone, with partings of greenish shale and full of corals. This,

[10] Guide Book No. 4, Int. Geol. Cong., 1913, pp. 83-84.

[11] Geol. Sur. Can., Summary Report, 1911, pp. 271-2.

[12] "In Huron and Bruce counties, where there is a great mass of Devonian limestones, the investigations of the past season [1912] have practically demonstrated that much of this deposit does not belong in the Onondaga, to which it has formerly been referred. This was suspected after a study of the material obtained on previous trips. A visit to Alpena, Michigan, and a few days collecting in the Alpena limestone (middle Hamilton) of that vicinity, revealed the same fauna in it as that which occurs in the Stromatoporoid reefs at the falls of Teeswater." C. R. Stauffer, Geol. Sur. Can., Summary Report for 1912, p. 293.

in turn, is overlain by somewhat more than 10 feet of very cherty dark bluish-black limestone with numerous corals, and passing upward into about 30 feet of very cherty, thinly bedded, grey limestone poor in fossils of any kind. The outcrops of Welland county are not so connected that the entire thickness of the formation can be obtained, but the indications are that it is about 100 feet. To the westward the central purer portion of the formation increases in thickness, at the expense of both the lower and upper cherty parts, and thus passes into the typical Onondaga of Michigan and Ohio. At some of the northern outcrops of this formation especially in Bruce county the rock is a most astonishing mass of corals and hydrozoans unlike anything else in the Province.

Marcellus Shale. In western Norfolk and eastern Elgin counties well records show from 10 to 30 feet of a black bituminous shale immediately overlying the Onondaga limestone. This shale is covered by from 200 to 280 feet of glacial drift, so that it cannot be definitely determined at the present time. However, its position in the geological scale strongly suggests its Marcellus age. And then in the high banks of the drift at Port Stanley are good-sized pieces of well preserved black shale carrying the Marcellus fauna. If these blocks of shale were derived from the bed-rock to the northeast, as is almost certain, there can be no further question as to the age of the deposit of black shale there reached by the drill.

Hamilton Beds. The Hamilton beds are made up of grey limestones and soft, blue shales. There are commonly three persistent limestones—a lower, middle, and upper—recognized in well sections, and it is the lower limestone that comes in direct contact with the Onondaga as the Marcellus shale pinches out to the westward. This lower limestone, as its fauna show, is the northward extension of the Delaware limestone of Ohio, and hence may represent, in part, the Marcellus shale lying farther to the east. The total thickness of the Hamilton beds ranges about 300 feet, although greater thicknesses are sometimes encountered.

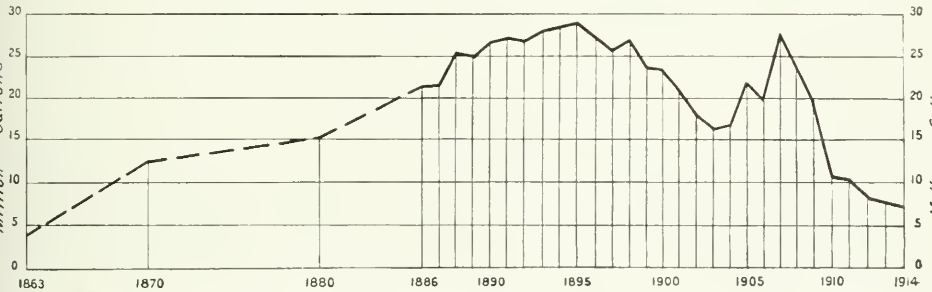

Fig. 3 Production of crude oil in Ontario up to the end of 1914 (from 1863 to 1886 estimate only). Compiled by G. R. Mickle.

Genesee Shale. This formation consists of a bituminous, fissile, black shale similar to that of the same formation to the south and east. As an evidence of the life which existed during the time of its deposition and of the conditions under which deposition took place, this shale contains carbonized plant stems and leaves, an abundance of the spore cases of certain plants, a lingula, and the occasional bones of large fishes. The Genesee shale lies immediately on top of the upper limestone of the Hamilton beds, and forms a very good outcrop at Kettle point, where the most striking feature is the large spherical concretions projecting from the shale. The thickness of these shales is not definitely known, but some well records indicate as much as 185 feet.

Portage and Chemung Beds. In a few of the well records, especially in Moore township, 20 to 50 feet of greenish shales and sandstones make their appearance on top of the black shales of the Genesee, and sometimes even interstratified with the upper layers of that formation. These cannot be definitely separated into two formations, nor have they been directly observed, but they probably belong to the horizon of the New York Portage and Chemung beds.

Oil Fields

The production of oil in the Province during the years 1863 to 1914, inclusive, is graphically shown in Fig 3. It will be noted, on comparison with Fig. 4, that for several years the yield of oil has been decreasing at a serious rate, while the production of gas, on the other hand, has been increasing. Table No. 1 gives the names and production in barrels of the oil fields for the years 1906-1914, inclusive. Oil occurs in the Onondaga (Corniferous), Oriskany,[12] Guelph, Niagara, Medina and Trenton. Below follows a brief description of these fields.

[12] Jour. Can. Min. Inst., Vol. VI., p. 110.

Lambton County Oil Field

The Lambton field has been producing continuously since 1862. In the first few months of its history a few of the wells yielded from 1,000 to 7,500 barrels daily; but at present, and for many years in the past, the average yield of a well is very small—probably 8 or 9 gallons a day. In 1905, for instance, E. T. Corkill noted a group of 100 wells which together were producing 150 barrels a month. It has been pointed out by T. W. Gibson[13] that "It is only the large number of wells, and the economy in management which long experience has taught the operators, that enables Lambton county to be reckoned among the oil producing regions to-day."

The wells are located in the townships of Enniskillen and Moore—largely in the former, where are situated the towns of Petrolia and Oil Springs. The Petrolia field is the largest in area in the Province, extending about ten miles northwest to southeast, with an average width of three miles.

Oil occurs at a depth of 370 to 480 feet below the surface, and at 60 to 70 feet below the top of and in the Onondaga[14] limestone.

The deepest well in Ontario was drilled at Petrolea, its depth being 3,777 feet.

Tilbury oil field, Kent county, showing the flat topography of the region

Tilbury or Kent Oil Field, Kent County

Oil was first discovered in East Tilbury township in 1905. Two years later, in 1907, the production had risen to 411,588 barrels; but by the year 1914 it had fallen to 18,530 barrels.

Oil occurs in the Tilbury field, which lies for the most part in East Tilbury township, and partly also in Romney and Raleigh townships, at a depth of 1,250 to 1,426 feet below the surface. According to Eugene Coste:[15]

> The two upper oil pays in the southern part of the field are found in the lower brown dolomites and gypsum of the Onondaga, while the lower oil pay is struck in the upper beds of the Guelph and Niagara. In the north end of the field, north of the Michigan Central railway, the lower beds of the Onondaga are barren of oil, which is there altogether found in the Guelph, but the gas is still found there in the lower beds of the Onondaga, in the strata which form the first and second oil pays of the south end of the field. In the east middle part of the field, on the other hand, the oil is struck in the Onondaga strata which constitute the gas pays in many of the wells of the middle western part of the field.

Bothwell Oil Field, Kent County

While the production of oil in this field has been gradually falling, table No. 1 shows that the Bothwell field in Zone township has been one of the steadiest producers

[13] Ont. Bur. Mines, Vol. XVIII., Part I., p. 33.
[14] The Onondaga in past years has been known as the Corniferous formation.
[15] Jour. Can. Min. Inst., Vol. X., p. 82.

in the Province during recent years. According to E. T. Corkill[16] the wells are shallow, averaging about 600 feet in depth, and the formations drilled through are very similar to the Lambton field. The oil in one of the wells occurs at a depth of 365 to 375 feet from the surface, and at about 188 feet below the top of and in the Onondaga.

Leamington Oil Field, Essex County

In 1902 oil was discovered in this small and now abandoned field at a depth of 1,040 to 1,125 feet in a porous dolomitic limestone of the Guelph formation. In 1905, the Hickey No. 4 had a flow of 1,200 barrels daily for the first three days, but it rapidly fell to about 200 barrels. The field is located in Mersea township.

Dutton Oil Field, Elgin County

Oil was struck in Dutton township about the year 1898, the production since being small. The oil occurs in the Onondaga, at a depth of 160 to 175 feet from the top of the formation.

Onondaga Oil Field, Brant County

The Onondaga oil field, named from the township in which it occurs, was discovered in 1910. According to G. R. Mickle[17] the oil is found in the White Medina, at a depth of about 550 feet.

Thamesville, Belle River and Comber Oil Fields

These three fields have not as yet become important producers.

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[16] Ont. Bur. Mines, Vol. XIV., Part I., p. 90.
[17] Ont. Bur. Mines, Vol. XX., Part I., p. 38.

Table No. 1, showing Names of Oil Fields and Production of Crude Oil in Ontario, 1906-1914.

	1906	1907	1908	1909	1910	1911	1912	1913	1914	Total
	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.
Lambton, Lambton County	377,286	304,212	265,368	243,123	205,456	184,450	150,272	155,747	154,186	2,040,100
Tilbury and Romney, Kent County	106,992	411,588	201,283	124,003	63,057	48,707	44,727	26,824	18,530	1,045,711
Bothwell, Kent County	44,827	42,727	39,228	38,092	36,998	35,243	34,486	34,348	33,961	339,910
Leamington, Essex County	39,652	6,133	9,334	5,929	141					61,189
Dutton, Elgin County	19,376	14,977	13,743	9,513	7,751	6,731	4,335	4,610	2,190	83,226
Onondaga, Brant County					1,005	13,501	7,115	4,172	2,438	28,231
Thamesville, Camden township, Kent County	175	237								412
Belle River, Rochester township, Essex County								465	1,191	1,656
Comber, Tilbury township, Essex County	651									651
	588,959	779,874	528,956	420,660	314,408	288,632	240,935	226,166	212,496	3,601,086

Natural Gas Fields[18]

Natural gas occurs in Ontario in the following formations:—Onondaga, Guelph, Clinton, Red Medina, White Medina and Trenton. In addition, less important amounts occur in the drift. There are six gas-producing fields in the Province, which have been described by G. R. Mickle in the following paragraphs. The value of gas produced in the Province during the years 1892 to 1914, inclusive, is shown graphically in Fig. 4.

Essex Field

This field was abandoned by the gas operators about two years ago [1912]. A few wells are still supplying gas to farm houses. The field was a small one, probably not over three square miles in area. A description with log of the first well drilled here is given in a paper by Eugene Coste entitled "Natural Gas in Ontario" (Jour. Can. Min. Inst. Vol. III). The following notes are taken from this paper. The well was drilled in January, 1889, on the extreme north end of the same lot as the one sampled [Fig. 6]. Gas was found at a depth of 1020-1031 feet in dolomite of the Guelph formation. The well measured over 10 million cubic feet "open flow" and registered 460 lbs. pressure.

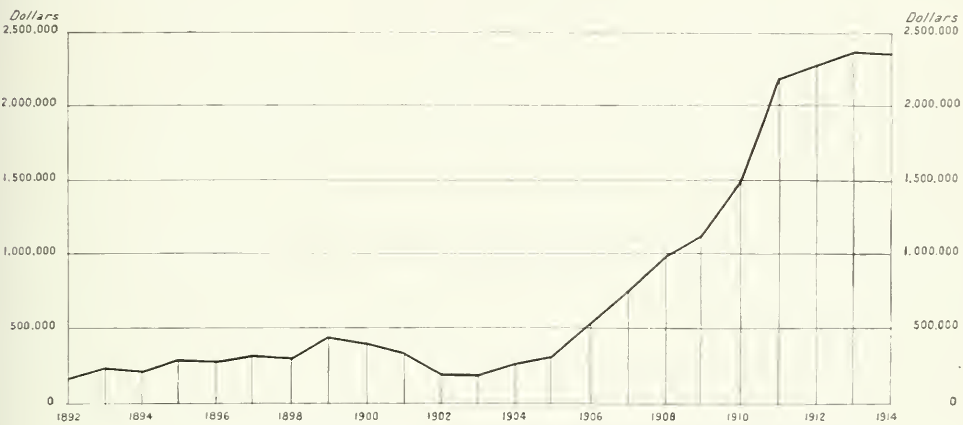

Fig. 4—Value of natural gas produced Ontario between the years 1892 and 1914

Kent Field

This small but valuable area first appeared as a gas producer in 1907. The production from this field up to the end of 1913 amounted to about 31,000 million cubic feet. The land area is about 31 square miles. It is often called the Tilbury field from one of the townships in which the gas is found, but a glance at the plan [Fig. 6] will show that the field takes in portions of the townships of Romney and Raleigh. All parts are not of equal value, the portion in Romney being particularly productive, and in general, the wells with the largest capacity are found in the southern part of the field adjoining Lake Erie. Undoubtedly the gas-bearing rock extends under the lake some distance. The gas is found in dolomite of the Onondaga formation.

Lambton Field

During the summer of 1913 several wells were drilled in Enniskillen township at Oil Springs, and gas discovered in moderate quantity, several hundred thousand cubic feet capacity; but it was not until the Fairbanks well was drilled in March, 1914, and a well giving a larger flow of gas than any found hitherto in Ontario was disclosed, that the probable importance of this discovery was realized.

The capacity when first drilled in was said to be 15,000,000 cubic feet, but since then it has proved a disappointment. Gas occurred at a depth of about 1,900 feet. The log of this well is given on page 85.

[18] The information on natural gas has been obtained from the important paper by G. R. Mickle on "The Chemical Composition of Natural Gas Found in Ontario," Ont. Bur. Mines, Vol. XXIII., pp. 35-38 and 237-273.

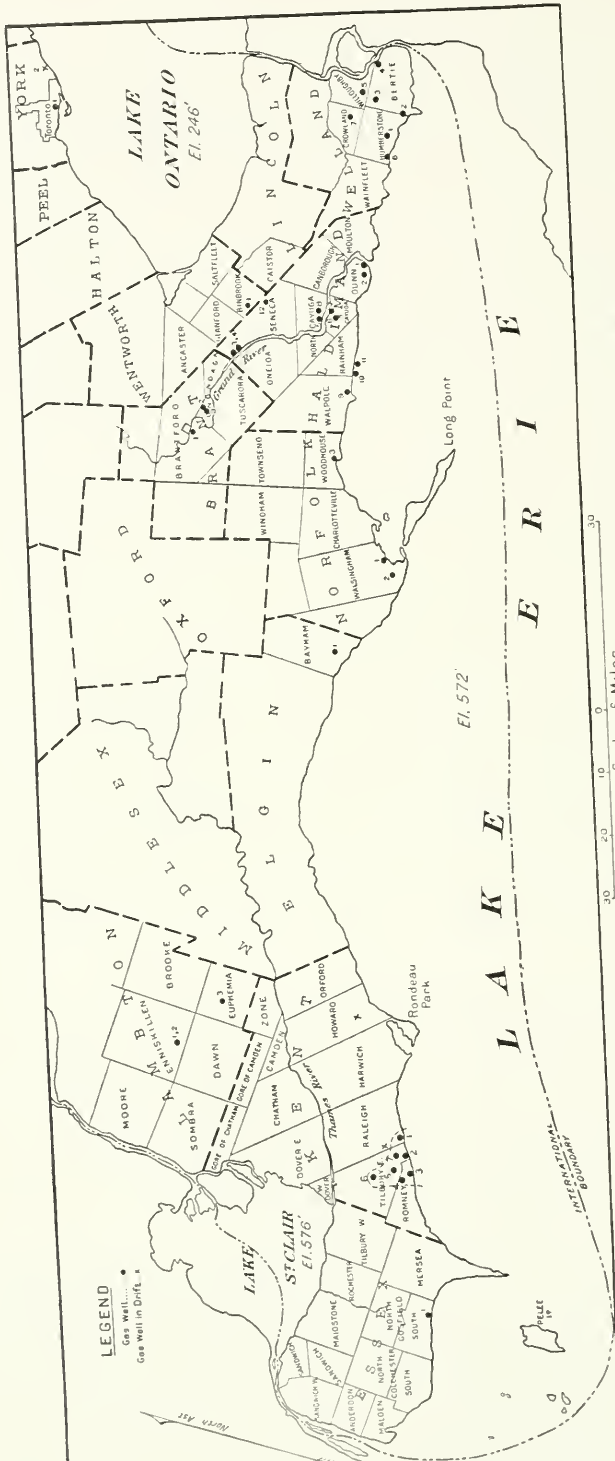

Fig. 5—Map of part of the province of Ontario, showing position of wells sampled by G. R. Mickle

Elgin Field

This small, producing area was discovered in 1910 in Bayham township. A well in the village of Vienna with a depth of 1,330 feet showed originally a pressure of 710 lbs., which in 1914 had fallen to 350 lbs. The gas occurred in the Clinton.

Welland-Haldimand-Norfolk-Brant Field

It is difficult to separate the areas in these counties. The first well was drilled in August, 1889, in Bertie township, Welland county, about two miles north of Welland No. 2 shown on plan [Fig. 6]. This well measured 1,700,000 cubic feet and was 836 feet deep, gas being in White Medina sandstone. The pressure was 525 lbs. This information is taken from paper above quoted by Mr. Coste, which contains logs of a number of wells in Welland county. Since that time the drilling has extended west ward through Haldimand and Norfolk counties, and up into Brant and Wentworth. In general the gas-bearing rock does not extend back far from Lake Erie. Most of the gas is obtained from Clinton and the Red and White Medina. There are wells in all the townships fronting on the lake, beginning with Bertie in the east, through Welland, Haldimand and Norfolk. Probably the most productive townships have been Bertie, Humberstone and Rainham. It cannot be regarded as a continuous field.

York, Scarborough Tp., Surface Gas

From well drilled for water at the St. Augustine Seminary, lot 25, Con. B', Scarborough township. The writer saw this for the first time, 20th Dec., 1913. Gas had then been blowing for seven days. Flow was measured and waste immediately stopped. Subsequently gas was piped to boilers and used for three weeks under boilers. Eighteen burners were in use, about inch diameter. Flow of gas checked by water. Probably 4 to 5 million cubic feet were produced altogether by this well. Elevation of surface where well was sunk 525 ft. above sea. Well stopped at 330 ft. in shale (Lorraine). Gas mostly found at 290 ft. This particular vicinity is famous among geologists who have studied the Pleistocene especially and has been fully described by Dr. A. P. Coleman.[19] According to his description of a section in the vicinity the gas was in the Toronto formation which is composed of interglacial beds extending 151 ft. above Lake Ontario and 41 below. The lake level being 246 ft., the top of the well is 279 ft. above the lake, and, therefore, at 290 ft. the well is 11 ft. below the lake level. Details regarding well were kindly furnished by the Rev. Father Kidd, President of the Seminary.

Chemical Composition of Ontario Natural Gases

Analyses of Ontario natural gases are given in Table No. 2. The wells which were sampled are numbered according to counties, which are indicated by heavy broken lines in the map, Fig. 5. This map shows the location of the gas fields of the Province.

[19] Excursions in vicinity of Toronto, Guide Book No. 6, Ont. Bur. Mines.

Table No. 2—Showing Analyses of Ontario Natural Gases

By Profs. W. H. Ellis, J. W. Bain, and E. G. R. Ardagh.

County and Well.	H_2S	C_2H_4	CO	H	CO_2	O	CH_4	C_2H_6	C_3H_8	N	Condensate.	lbs. on well.
Essex No. 1......	0.3	none	none	none	none	none	87.6	7.3	none	4.8	.....	50
Kent No. 1.......	trace	"	"	?	0.1	"	76.1	18.0	"	5.8	.....	565
Kent No. 2.......	0.3	"	"	none	none	"	84.4	10.8	"	4.5	10.6	522
Kent No. 3.......	0.6	"	"	"	0.1	"	86.0	8.5	"	4.8	.....	436
Kent No. 4.......	0.5	"	"	"	0.5	"	86.8	7.9	"	4.8	.....	400
Kent No. 5.......	0.4	"	"	"	0.3	"	83.4	10.6	"	5.3	.....	450
Kent No. 6.......	0.8	"	"	"	none	trace	78.2	15.7	"	6.1	.....	418
Kent No. 7.......	0.8	"	"	"	?	none	84.1	8.5	"	5.8	.....	519
Kent "Surface" Tp. Howard....	none	"	"	"	none	"	83.0	none	"	17.0	.....	50?
aKent "Surface" Tp. Raleigh....	"	"	"	"	0.1	0.3	92.9	"	"	6.7	.....	?
Lambton No. 1...	"	"	"	"	none	none	68.3	12.5	3.4	15.8	11.6	830?
Lambton No. 2...	"	"	"	"	"	"	69.0	15.7	1.8	13.5	9.1	830
Lambton No. 3...	"	"	"	"	"	"	80.2	11.7	none?	8.1	.....	?
Elgin No. 1......	"	"	"	"	"	"	84.1	10.8	"	5.1	.....	350
Norfolk No. 1....	"	"	"	"	"	"	84.4	6.8	"	8.8	.....	400
Norfolk No. 2....	"	"	"	"	"	"	83.8	7.7	"	8.5	.....	545
Norfolk No. 3....	"	"	"	"	"	"	75.8	14.2	"	10.0	.....	?
Haldimand No. 1.	"	"	"	"	"	"	67.8	16.0	3.5	12.7	17.6	275
Haldimand No. 2.	"	"	"	"	"	"	79.7	11.4	none	8.9	10.8	300
Haldimand No. 3.	"	"	"	?	"	"	76.7	14.6	"	8.7	.....	10
Haldimand No. 4.	"	"	"	"	"	"	81.7	11.7	"	6.9	.....	140
Haldimand No. 5.	"	"	"	"	"	"	79.4	14.3	"	6.3	.....	225
Haldimand No. 6.	"	"	"	"	"	"	81.8	11.8	"	6.4	.....	250
Haldimand No. 7.	"	"	"	"	"	"	76.6	16.3	"	7.1	10.8	285
Haldimand No. 8.	"	"	"	"	"	"	76.3	15.4	"	8.3	.....	250
Haldimand No. 9.	"	"	"	"	"	"	84.9	8.3	none	6.8	.....	87
Haldimand No. 10	"	"	"	"	"	"	77.6	15.4	"	7.0	.....	100
Haldimand No. 11	"	"	"	"	"	"	77.8	14.7	"	7.5	.....	100
Haldimand No. 12	"	"	"	"	"	"	80.0	11.4	"	8.3	.....	?
Wentworth No. 1.	"	"	"	"	"	"	80.2	13.1	"	3.7	.....	186
Brant No. 1......	"	"	"	"	"	0.1	76.9	8.0	1.2	13.8	7.8	20
Brant No. 2......	"	"	"	"	"	none	68.6	19.0	none	12.4	14.7	?
Brant No. 3......	"	"	"	?	"	0.5	74.6	15.4	"	10.0	.....	?
Welland No. 1....	"	"	"	"	"	none	74.8	17.3	"	7.9	15.6	50
cWelland No. 2....	"	"	"	"	"	0.2	80.0	12.9	"	7.1	.....	100
Welland No. 3....	"	"	"	"	"	none	82.1	13.5	"	4.4	.....	100
Welland No. 4....	"	"	"	"	0.05	0.05	83.6	12.0	"	4.3	.....	120
Welland No. 5....	"	"	"	"	0.15	0.05	93.7	3.3	"	2.8	.....	50
Welland No. 6....	"	"	"	"	none	none	75.6	15.5	"	8.9	.....	185
Welland No. 7....	"	"	"	"	"	"	85.9	8.7	"	5.4	.....	6
York No. 1.......	Results given separately below											
York, Scarborough Tp. "Surface".	"	"	"	"	1.65	"	85.15	0.0	"	13.2	.....	5

(a) As this gas was probably in contact with water and might have taken oxygen from that, we cannot assume the O was due to sampling; no correction is, therefore, made. The sample was taken by displacing water.

(b) This is the highest O in any sample taken with water. The rubber tubing was blown off during operation; no correction made.

(c) Corrected to air free sample. Taken "dry."

Analysis of York No. 1 by Prof. E. G. R. Ardagh

Carbon dioxide	0.1
Carbon monoxide	1.2
Ethane	3.1
Hydrogen	none
Hydrogen sulphide	none
Methane	86.0
Olefines	1.3
Oxygen	none
Nitrogen	8.3
	100.0

Note.—The carbon monoxide and olefines appear in the analysis at the expense of the methane and ethane, but the relative proportions in which this took place are not known.

Influence of Geological Formations on Gas

The analyses so far as the evidence goes, do not appear to show that the geological formation in which the gas is found has any influence on the composition. In taking the samples from Welland county a special effort was made to ascertain this. Gas is found in four different rocks in that county, viz.: the Clinton, average depth about 700 ft., Red Medina 765 ft., White Medina 810 ft., and Trenton. As many wells derive their gas from two or more of these sands, the drilling records were examined carefully to select wells which yielded gas in only one formation. Accordingly 1 and 2 were taken to represent the White Medina and 3 and 4 the Clinton, and 5 the Trenton. Red Medina was left for Haldimand county. But it is seen that No. 2 is similar to 3 and 4 and different from 1. Afterwards two more samples were taken in Welland—No. 6 in White Medina and 7 in a mixture of Clinton and White Medina gas. If we conclude that the White Medina gas is higher in ethane than the Clinton basing that on 1 and 6, then the results of 2 are inconsistent with this. Moreover, No. 7 is lower in ethane than either of the other Clinton or White Medina gases, although it is a mixture of the two. No. 5, as explained before, is from the only well in the Trenton, consequently we cannot say whether the low ethane and nitrogen is due to the influence of the rock or its position. Coming into Haldimand, No. 1, the highest ethane is in White Medina; 7 and 8 are the next highest and are in Red and White Medina respectively. The lowest ethane in Haldimand is No. 9 in Red Medina, and so on—no definite differences.

In the western fields the gas is all obtained from one formation in the same field.

Effects of Declining Pressure on Composition

In the old field of Welland-Haldimand, etc., a number of wells which are almost exhausted were sampled purposely to see if there was any difference between the low and high pressure wells. The viscosity of a gas, or the measure of the difficulty with which it flows through an orifice of any kind, is supposed to vary directly with the square of the specific gravity, that is, the one with the higher density would find its way less readily through the pores and consequently we should expect the low specific gravity constituents to escape first, and, therefore, there would be a concentration of the higher density gases in wells that are nearly exhausted. Taking the specific gravities of the gases constituting natural gas, and it will be sufficient to use approximations. We have 0.6 for methane, 1.0 for ethane, 1.0 for nitrogen, and 1.5 for carbon dioxide; then the square of methane density is .36 and carbon dioxide 2.25 or methane should escape about six times as readily as carbon dioxide. Hence there should be a concentration of carbon dioxide in an old well. Unfortunately this latter gas which would be our best indicator is practically absent in the Ontario gases. Welland No. 5 is the only one in the eastern part showing more than a trace. Since this well has experienced the greatest drop in pressure of all—from 1,000 lbs. to less than 100—we should expect to see it higher in carbon dioxide, as indeed, it is, and also, higher in ethane and nitrogen. Actually it is lower in these latter two than any other of the gases in that vicinity. A careful scrutiny of the list of analyses of gas from Haldimand will show that there is no apparent concentration of ethane and nitrogen in the nearly exhausted wells. Of course we have no proof that all of them are not higher in these two gases than they were originally. This brings us back to the necessity of systematic sampling of the wells in any given field at different periods of its productive life if we are to acquire a complete knowledge of the composition. This was explained fully above.

Uniformity of Composition of Natural Gas in Ontario

The most striking feature in the whole set of analyses is the wonderful uniformity of the gas derived from widely separated, and as far as the information from drilling goes, totally disconnected areas. For instance, the sample from the small field in Elgin which is 80 miles from the Kent field, is almost identical with the normal gas from the latter area, the ethane being only 1.5 per cent. higher than the mean of normal Kent gas, and the nitrogen agreeing within .1 per cent. If a dash of hydrogen suphide were added to this gas it would agree exactly with the Kent product, or, conversely, remove that fraction of one per cent. from the Kent and Essex gas and all these three would agree. Yet Kent is separated from Essex by twenty miles and Elgin from Kent by eighty. By the addition or subtraction of a very few per cent. of one or more constituents most of the apparently quite separate areas would be yielding the same gas. The almost complete absence of carbon dioxide in the Ontario gases is peculiar, only one sample in all the 27 examined from Elgin eastwards showing the small quantity of .15 per cent. and one a few hundredths of a per cent. An examina-

tion of the analyses quoted from other territories shows that carbon dioxide is more often present than not. When we consider that there are more than a hundred ways in which two dry commercial gases can differ and only one in which they can agree, this uniformity is surprising. It seems to be incompatible with a local and separate origin for each field. We can understand why the oxygen and nitrogen of the atmosphere are found in constant proportions in all parts of the world. There is only one atmosphere. Those who have theories to defend may be left to adjust them to the observed facts.

Surface Gas

The occurrence of gas in the drift in many places in Ontario is of both economic and scientific interest. Analyses are given of this kind of gas from two different localities in Kent county and one in York. In one place as explained above, this gas has been in use for 21 years in several houses and shows no manifest sign of diminution. To form some idea of the quantity this involves the writer secured through the kindness of the Union Natural Gas Company which has a number of pipe lines traversing the county of Kent, an estimate of the average amount of gas consumed by a household in the territory they serve. Twenty farm houses were taken at random and the average amount of gas they use per year was ascertained. The price paid there is 15 cents per thousand feet and the average consumption is 220,000 ft. per year per household. In the county of Welland similar figures were obtained from the Provincial Natural Gas and Fuel Company, the average consumption per household came to 102,000 cu. ft. per year, the price of gas being 30 cents per thousand. There is no climatic or other reason except the price why the consumption should be higher in one place than the other. It is certain that households using gas which costs nothing will not consume less. The quantity is more likely to be 300,000 ft. per year or more, so that the total amount consumed by one of these houses in 21 years is probably 6 million feet or more.

All these gases examined contained over 80 per cent. methane. and, therefore, probably have a calorific value of over 800 B.T.U. per cubic foot, methane having over 1,000. The cheapest artificial gas sold in Ontario is in Toronto, where the price is 70 cents per thousand for a gas with a heat value of about 600 B.T.U. If one were buying this natural gas on the same basis, the price should be about 90 cents per thousand. It would no doubt be considered a boon in many houses if it could be delivered into the country at that price. A value of 50 cents per thousand could reasonably be put on this natural gas. This is equivalent to $500 per million, so that the value to the households of the 6 million feet used is not less than $3,000. As explained already, several farms in Howard township have used this gas. There are also some in other parts of Kent county. The probabilities must be strong that there are a number of places in Scarborough also where a supply of gas could be obtained from the drift for years sufficient for individual houses, provided reasonable economy is employed.

Oil and Gas in the Trenton

The Trenton limestone being the most important source of oil in the state of Ohio, and one of the most important oil-bearing formations in the world, it is of interest to inquire into the possibilities of this formation as a producer of oil and gas in Ontario. In reference to the subject, W. A. Johnston[20] remarks:

Regarding the possibility of obtaining natural gas or oil in the district by boring, it may be stated that a great many borings have been made into and through the limestones of the Trenton and Black River groups in Ontario; but, so far as is known gas or oil has not as yet been found in commercial quantities in these limestones in Ontario. In a number of instances natural gas, with a considerable initial pressure, has been struck in the Trenton, but the pressure soon so lowered as to make the production of little commercial value. Oil in small quantities has also been reported from the Trenton, in a few localities in Ontario. These occurrences appear to be confined for the most part to the upper 200 feet of the Trenton, but in a few instances gas has been struck lower down in the formation, and even in the coarse sandstone or arkose at the base of the series. Where the whole of the series is developed in adjacent districts, the limestones of the Trenton and Black River groups have a thickness of about 600 feet; the upper 200 feet are somewhat porous, but the lower portion is composed, for the most part, of fine-grained, compact limestone, unsuited for the storage of gas or oil.

[20] Geol. Sur. Can., Summary Report, 1912, p. 300.

It may be added that the broad belt of Trenton and Black River limestones which is exposed for 100 miles along the north shore of lake Ontario, and which stretches northwesterly to Georgian bay, where it is only about 20 miles wide, lacks the thick covering of impervious shales necessary for the retention of oil or gas. Hence, it is probable that, even if oil and gas had ever been present in this belt, they have long since largely escaped. Further, resting near the great expanse of pre-Cambrian rocks, as this belt of Trenton and Black River does, the escape of oil or gas would be obviously facilitated.

Oil Shale

It is interesting to recall the not generally known fact that at one time oil shale was distilled near Collingwood, where the Utica formation contains a bed of this material about seven feet in thickness. An exposure of the shale is found on lot 23, in the third concession of the township of Collingwood, Grey county. Many years ago a specimen of the shale was analyzed by Sterry Hunt, and showed 53 per cent. calcium carbonate with "a little magnesia and oxide of iron." The insoluble argillaceous residue when ignited in a closed vessel gave 12.6 per cent. of volatile combustible matter, leaving a coal-black carbonaceous residue, which, when calcined in the open air lost 8.4 per cent. additional.

Bituminous shales are also reported to occur on the eastern end of Manitoulin island at Cape Smyth, and at Kettle point on Lake Huron.

In 1859, a plant to treat the shales was erected near Collingwood. The shales were distilled in iron retorts heated by means of wood, and it is said that from thirty to thirty-six tons of shale were treated daily, yielding 250 gallons of crude oil at a cost of 14 cents a gallon. When refined the crude oil yielded from 40 to 50 per cent. of burning oil and from 20 to 25 per cent. of pitch and waste, the remainder being a heavy lubricating oil. After two or three unsuccessful trials, and the repeated destruction of the works by fire, they were in 1860 got into operation, and a ready market found for the oils; but it is not known that the enterprise was remunerative. The business was abandoned, probably on account of the cheap oil from Petrolia, which at that time was brought into the market in large quantities. This process of distilling oil shales in Ontario was a primitive one when compared with the complex and efficient plants used in Scotland at the present time, concerning which a word may be added.

The Shale Oil Industry in Scotland

Immense quantities of oil shales exist in Scotland, and serious attempts to distil the oil from the shales were made in 1859 at Broxburn. After the industry had had its ups and downs it finally passed into the profitable stage. The manufacture, as a by-product, of sulphate of ammonia, which is used as a fertilizer, helped to place the industry on a paying basis.

The shales, when crushed, are distilled in retorts heated externally by the ignition of the incondensable gases given off by the shales themselves during their distillation. Nitrogen is converted into ammonia in the hot retorts by injecting steam under slight pressure. The oil-gases and ammonia gas are drawn off and partly condensed in condensers into oil and ammonia water respectively, which, having distinct specific gravities may be drawn off into separate tanks. That part of the gas which was not condensed in the condenser is "washed," and the remaining incondensable gas is used to heat the retorts as noted above. The crude oil thus obtained from the shale is refined in about the same manner as petroleum, and yields almost as varied and numerous products. In fact, the illuminating oils are superior to those obtained from petroleum. The average yearly output in Scotland is 20,000,000 gallons of illuminating oils; 5,000,000 gallons of naphthas; 22,000,000 gallons of lubricating oils; 25,000 tons of paraffin wax; and 54,000 tons of sulphate of ammonia.

It is said that this Scottish process might be introduced in New Brunswick to treat the extensive oil shales in that Province.

The Scotch oil shales give an average yield of 25 gallons per ton.

Index of Well Records

(The records of wells in the following pages are classified under counties. In place of arranging the counties in alphabetical order, it was considered more convenient for reference to begin with the counties on the east of the Province and continue in a general way to the west.)

WELL RECORDS IN ONTARIO

[NOTE.—The records marked with an asterisk have been furnished through the kindness of the Geological Survey of Canada; they have not hitherto been published.]

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Glengarry County			
Alexandria (Geol. Sur. Can., Vol. VIII, p. 69A):			
Trenton			
Dark grey, impure limestone	470	470	
Black River			
Dark grey, impure limestone	100	570	
Chazy			
Dark grey, impure limestone, underlain by greenish grey, calcareo-arenaceous shales—at times fine-grained, at others coarse and more highly arenaceous	185	755	
Calciferous			
Hard, compact, dark, chocolate-coloured limestone, probably magnesian	31	786	
Lancaster tp., l. 21, con. II (Geol. Sur. Can., Vol. V, Part II, p. 21Q):			
Clay, sand gravel	30	30	
Trenton?			
Limestone	470	500	
Prescott County			
Caledonia Springs (Geol. Sur. Can., Vol. V, Part II, p. 22Q):			
Surface deposits	100	100	
Trenton	?		
*Fournier:			
In August, 1903, depth of well was 800 feet. Black shales at 645, 675, 680, 685, 690, 695, 700, 705, 710 feet. Trenton limestone at 790 feet.			
Stormont County			
*Monckland:			
Sunk by C. P. Ry. near the station to a depth of at least 1,000 feet.			
Carleton County			
Ottawa (Geol. Sur. Can., Vol. V, Part II, pp. 22-23Q):			
Total depth of well, 1,005 feet.			
Specimen from 30 feet—Limestone, light blue.			
" " 35 " " shaly, dark blue.			
" " 82 and 110 feet—Limestone, light blue.			
" " 120, 140 and 150 feet—Limestone, shaly, dark blue.			
" " 160, 180 and 185 feet—Limestone, light blue.			
" " 190 feet—Limestone, soft, shaly (thin laminae), arenaceous.			
" " 195 to 220 feet—Limestone, grey.			
" " 225 feet—Limestone, dark blue.			
" " 230 " " light grey.			
" " 240 " " " " with chert			
" " 250 " " " "			

Well Records in Ontario—Continued.

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Carleton County—Continued			
Between 250 and 310 feet a streak of sandstone similar to that at 310 feet is said to have been traversed, though of what thickness is unknown.			
Specimen from 310 feet—Sandstone, fine-grained, highly calcareous.			
" " 315 " Limestone, with pyrite.			
" " 335 " "			
" " 350 " " dark blue, with pyrite.			
" " 380 " " blue, with quartz.			
" " 475 " " light blue, with pyrite in abundance.			
Below this point, it is said that nothing but light blue limestone was found, which may possibly be of the Black River formation.			
*Ottawa, Y.M.C.A., Laurier avenue West: Total depth of well, 1,189 feet. Sunk to Potsdam sandstone.			
*Ottawa: Following is a list of a number of wells in Ottawa that were bored for gas:			
Location			
1. Anglesea square		170	
2. Cathcart square		342	
3. Queen and Lloyd streets		265	
4. Fourth avenue and Lyon street		371	
5. Evelyn school		323	
6. Osgoode Street school		250	
7. Richmond Avenue school		203	
8. Hopewell Avenue school		398	
9. Elgin Street school		900	
10. Bay and Somerset streets		1,377	
Nos. 1, 2, 3, 4 and 6 were in the Trenton group of rocks; Nos. 5 and 8 started in the Utica and ended in the Trenton group; No. 7 started in the base of the Trenton group; No. 9 started at the top of the Trenton and penetrated to the Chazy; No. 10 was carried to the pre-Cambrian and penetrated it about 10 feet.			
Hastings County			
Deseronto (Geol. Sur. Can., Vol. V, Part II, p. 24Q):			
Surface deposits	15	15	
Limestone	45	60	
Ontario County			
Whitby, l. 28, 7th double range, west of Brock street (Geol. Sur. Can., Vol. V, Part II, p. 24Q):			
Surface deposits	50	50	400 Gas
Utica			700 "
Shale	70	120	
Trenton			
Limestone	600	720	
Arkose	8	728	
Small quantities of gas were found at 400 and 700 feet.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
York County			
Highland Creek (Geol. Sur. Can., Vol. V, Part II, p. 24Q):			
Surface deposits (blue clay)	48	48	434 Gas
Hudson River and Utica			
Shale	200	248	
Trenton			
Limestone	434	682	
Gas reported in the Trenton.			
Copeland's brewery, Parliament street, Toronto (Geol. Sur. Can., Vol. V, Part II, p. 25Q):			
Surface	40	40	
Hudson River			
Limestone	150	190	
Hudson River and Utica			
Shale	405	595	
Trenton			
Limestone	585	1,180	
Arkose	20	1,200	
Pre-Cambrian			
Granite			
*Vaughan tp., l. 33, con. I:			
Surface	641	641	
Shale, grey, hard	85	726	
Limestone, grey, hard	119	845	
Shale, black, hard	96	941	
Limestone, grey, soft	90	1,031	
Limestone, dark grey, hard	159	1,190	
Shale, soft	8	1,198	
Granite, red	2	1,200	
Swansea, Toronto (Ontario Bolt Works, east side Humber river) (Geol. Sur. Can., Vol. V, Part II, p. 25Q):			
Surface			
Sand	65	65	
Quicksand	15	80	
Hardpan	27	107	
Hudson River and Utica			
Grey shale	440	547	
Black shale	40	587	
Grey shale	56	643	
Trenton			
Limestone	107	750	
"Soapstone"	5	755	
Limestone	480	1,235	
"Fossil rock"	10	1,245	
Pre-Cambrian			
Crystalline limestone	16	1,261	
Top of well 347 feet above tide.			
New Toronto, west side of Seventh street (Geol. Sur. Can., Vol. VI, p. 109S):			
Surface deposits	5	5	780 Gas
Shale, black	640	645	885 ,,
Limestone	595	1,240	1,089 ,,
Sandstone and arkose	72	1,312	
York township, l. 11, con. III:			
Surface deposits	38	38	
Hudson River and Utica			
Shale	440	478	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
York County—Continued			
Trenton			
Limestone, hard	300	778	
" soft, with shale	185	963	
" hard	146	1,109	
"Arkose" beds	10	1,119	
Pre-Cambrian			
Granite	8	1,127	
*Cooksville:			
Depth of well, 1,010 feet.			
Gas in small quantity.			
Mimico (Geol. Sur. Can., Vol. V, Part II, p. 26Q):			
Surface	7	7	425 Gas 575 ,, 1,052 ,,
Hudson River and Utica			
Blue shale	493	500	
Brown shale	223	723	
Trenton			
Limestone	337	1,060	
Small quantities of gas were obtained at 425, 575 and 1,052 feet.			
Simcoe County			
Collingwood (Geol. Sur. Can., Vol. V, Part II, pp. 26-27Q):			
Well No. 1, lot 16, west side Peel street			
Surface	10	10	140 Gas 160 ,,
Trenton			
Limestone	543	553	
Gas was struck in small quantities at 140 and 160 feet.			
Well No. 2, lot 21, east side Oak street			
Soil	2	2	160 Gas
Trenton			
Limestone	540	542	
Gas at 160 feet, daily flow of 4,000 cubic feet.			
Well No. 3, about half a mile S.E. of No. 2			
Soil	4	4	175 Gas
Trenton			
Limestone	460	464	
Gas met with at 175 feet.			
Well in rear of the Hurontario flour mill in eastern part of Collingwood			
Trenton			
Limestone	351	351	150 Gas
Gas met with at 150 feet, about 2,000 cubic feet per day.			
Orillia (Geol. Sur. Can., Vol. V, Part II, p. 28Q):			
Surface deposits	170	170	
Trenton			
Limestone	130	300	
Numerous wells have been sunk in the town of Barrie to depths of 250 to 276 feet. Gas was not noticed. (Geol. Sur. Can., Vol. V, Part II, p. 28Q.)			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Simcoe County—Continued			
Beeton (Geol. Sur. Can., Vol. V, Part II, p. 29Q):			
Surface	321	321	321 Gas
"Medina"			
Soft sand rock	25	346	
Limestone	850	1,196	
Utica and Hudson River			
Shale	204	1,400	
NOTE.—The record of this well is imperfect. Gas was obtained from a soft sand rock at the base of the surface deposits, and smaller quantities throughout the rock to a total depth of 500 feet. Another well gave gas at 190 feet at the base of the surface deposits.			
*Tiny tp., l. 14, con. XIV:			
Clay	162	162	
Sand	45	207	
Hard clay	190	397	
Boulders	12	409	
Gravel	3	412	
Barrie (Geol. Sur. Can., Summary Report, 1912, p. 300):			
Surface deposits	375	375	
The boring continued through nearly 200 feet of the limestones of the Trenton and Black River groups to the pre-Cambrian. At the base and resting on the pre-Cambrian gneiss there were about 20 feet of coarse sandstone or arkose, and interbedded with the sandstone a few feet of reddish and bluish shales.			
Peel County			
*Brampton:			
Depth of well, 1,575 feet.			
Grey County			
Osprey tp., S.E. corner, l. 10, con. XI (Ont. Bur. Mines), 15th Report, Part I, p. 109):			
Surface			
Soil and clay	6	6	1,361 Gas
Gravel	6	12	1,760 to 1,765 Oil
Guelph and Niagara			
Limestone with mud seams; from 130 to 170, white crystalline porous limestone; from 170 to 195, grey limestone, with spathic iron and a little shale	183	195	
Niagara			
Grey blue shales	32	227	
Clinton			
Dark grey, hard limestone	48	275	
Medina			
Red shales	255	530	
Hudson River			
Blue shales and lime shales	530	1,060	
Utica			
Black shales	100	1,160	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Grey County—Continued			
Trenton			
Limestone and shales intermixed in small layers.	30	1,190	
Solid, compact, dark grey limestone, mostly shaly.	563	1,753	
Calciferous			
White calcareous sandstone	12	1,765	
Purple micaceous iron shales	10	1,775	
Grey granite arkose or coarse sandstone..........	10	1,785	
Red " " "	15	1,800	
Pre-Cambrian			
Granite	1	1,801	
Derrick floor 1,550 feet above sea level.			
Collingwood tp., l. 26, con. V (Geol. Sur. Can., Vol. V, Part II, p. 29Q):			
Surface	8	8	95 Gas
Utica			
Black shale	40	48	
Trenton			
Limestone	539	587	
Gas met at 95 feet; daily flow of 6,000 cubic feet per day.			
Thornbury (Geol. Sur. Can., Vol. V, Part II, p. 30Q): Depth of well, 550 feet; small show of gas.			
St. Vincent tp., l. 25, con. VII (B. Doran):			
Clay and gravel	18	18	
Blue shale	162	180	
Dark blue shale	70	250	
Black shale	10	260	
Grey rock	5	265	
Black shale	2	267	
Grey rock	2	269	
Black shale	2	271	
Grey rock	3	274	
Black shale	2	276	
Grey rock	5	281	
Trenton	423	704	
*Northwest corner Sarawak tp., north of Owen Sound; on Goodfellow's farm:			
Surface	6	6	
Rock	29	35	
Blue shale	7	42	
Red shale	90	132	
Middle limestone	17	149	
Soap rock	556	705	
Black shale	30	735	
Trenton limestone	469	1,204	
*Keppel tp., l. 38, con. II, north centre diagonal. Furnished by Imperial Oil Co.:			
Surface	14	14	
Limestone	190	204	
Slate	10	214	
Red rock	50	264	
Slate	20	284	
Limestone		344	
Slate		364	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Grey County—Continued			
Red rock	90	454	
Slate	60	514	
Red rock	45	559	
Shale	473	1,032	
Trenton	468	1,500	
Bruce County			
Hepworth, Amabel tp.:			
Surface deposits	8	8	1,409 Gas
Top lime, Niagara and Clinton	200	208	
Green shale, Niagara and Clinton	9	217	
Red rock, Medina	60	277	
Slate (blue shale)	40	317	
Lime	40	357	
Slate	25	382	
Red rock	85	467	
Slate	70	537	
Red rock	20	557	
Slate, soft	468	1,025	
Utica shale	25	1,050	
Trenton	359	1,409	
Amabel tp., l. 1, con. X (Ont. Bur. Mines, Vol. XV, Part I, p. 109):			
Surface			
Soil	4	4	1,405 Gas
Niagara, Clinton			
Limestone, shales	191	195	
Medina, Hudson River and Utica			
Shales	750	945	
Trenton			
Limestone	625	1,570	
Calciferous			
Sandstone	30	1,600	
Pre-Cambrian			
Granite	50	1,650	
Top of well 950 feet above sea level.			
*Amabel tp., l. 6, con. XI. Furnished by the Imperial Oil Company:			
Surface	15	15	Small 1,471 Gas
Limestone	225	240	
Slate	10	250	
Red rock	50	300	
Slate	20	320	
Limestone	60	380	
Slate	10	390	
Red rock	90	480	
Slate	60	540	
Red rock	35	575	
Shale	481	1,056	
Trenton	415	1,471	
*Amabel, l. 4, con. VI. Furnished by Imperial Oil Co.:			
Surface	33	33	
Limestone	220	253	
Slate	10	263	
Red rock	60	323	
Slate	40	363	
Limestone	50	413	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Bruce County—Continued			
Slate	15	428	
Red rock	85	513	
Slate	70	583	
Red rock	20	603	
Shale	489	1,092	
Trenton	586	1,678	
Inverhuron (Geol. Sur. Can., Vol. V, Part II, p. 58Q): The strata are reported to be identical with those at Kincardine for 895 feet; blue shale and gypsum were then encountered, slightly impregnated with salt; after which came Niagara shales, and at 1,007 feet hard limestone, holding back water with an offensive odour. Top of well 587 feet above tide.			
Port Elgin (Geol. Sur. Can., Vol. V, Part II, p. 58Q): At a depth of 890 feet the boring was carried through red shales. These shales are probably of Medina age, as the well was begun in the base of the Onondaga, which appears on the surface at Southampton, five miles farther north. Top of well 587 feet above tide.			
Southampton (Geol. Sur. Can., Vol. V, Part II, p. 59Q):			
Surface	233	233	
Sand rock	18	251	
Sandstone and limestone	150	401	
Limestone, dark grey and white	200	601	
Limestone, soft, light-coloured	99	700	
Shales, blue and red	96	796	
Limestone, white	34	830	
Shale, blue and red	225	1,055	
Shale, blue	200	1,255	
Top of well 587 feet above tide.			
Kincardine (Geol. Sur. Can., Vol. V, Part II, p. 59Q):			
Sand and gravel	91	91	
Limestone and hard strata	509	600	
Shale, red	23	623	
Shale, blue with red bands	117	740	
Limestone	30	770	
Shale, blue and red	125	895	
Rock salt	14	909	
Top of well 607 feet above tide.			
Kincardine (Geol. Sur. Can., Vol. V, Part II, p. 59Q):			
Surface	89	89	
Sandstone and limestone, alternate layers	28	117	
Limestone	179	296	
Sandstone, white, fine-grained	29	325	
Limestone, dark coloured	276	601	
Shale, red	14	615	
Shale, blue	115	730	
Limestone, hard, blue	164	894	
"Cherty rock"	5	899	
Rock salt	12	911	
Shale, blue, clay and salt in alternate layers	36	947	
Rock salt	60	1,007	
Top of well 607 feet above tide.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Manitoulin Island			
Eastern end Manitoulin island, about two miles southeast of Wekwemikong:			
Well No. 1 (Ont. Bur. Mines, Vol. XV, Part I, pp. 72-73):			
Niagara			
Limestone	50	50	398 Gas
Utica and Hudson River			
Light shale	250	300	
Grey shale	62	362	
Black shale	21	383	
Trenton			
Limestone	137	520	
Top of well 736 feet above sea level.			
Well No. 2			
Surface deposits	34	34	380 Oil and Gas
Niagara and Hudson River			
Limestone and shales	90	124	
Hudson River and Utica			
Light shale	161	285	
Grey shale	65	350	
Black shale	9	359	
Trenton			
Limestone	50	409	
Well No. 4			
Surface deposits			
Sand	15	15	
Niagara			
Limestone	50	65	
Hudson River			
Light shale	250	315	
Dark shale	70	385	
Utica			
Black shale	22	407	
Trenton			
Limestone	?		
Well No. 5			
Surface deposits			
Sand	14	14	437 Oil
Niagara			
Limestone	50	64	
Utica and Hudson River			
Light shale	250	314	
Dark shale	94	408	
Black shale	12	420	
Trenton			
Limestone	17	437	
Manitoulin island (Geol. Sur. Can., 1863-66, p. 252-3):			
Surface deposits	10	10	220 Oil
Shales	140	150	226 ,,
Limestone	316	466	
Surface deposits	32	32	193 Oil
Black shale	100	132	248 ,,
Limestone	340	472	270 ,,
Red siliceous sandstone	52	524	
Surface deposits	21	21	288 Oil
Shale	230	251	
Limestone	179	430	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Huron County			
Goderich (Geol. Sur. Can., Vol. V, Part II, p. 53Q-54Q):			
Surface deposits			
Gravel	14	14	
Blue clay	31	45	
Boulders	10	55	
Gravel	4	59	
Boulders	13	72	
Sand and clay	7	79	
Dolomite, with thin limestone layers	278	357	
Limestone, with corals, chert and beds of dolomite	276	633	
Dolomite with seams of gypsum	243	876	
Variegated marls, with beds of dolomite	121	997	
Rock salt, 1st bed	31	1,028	
Dolomite, with marls towards the base	32	1,060	
Rock salt, 2nd bed	25	1,085	
Dolomite	7	1,092	
Rock salt, 3rd bed	35	1,127	
Marls, with dolomite and anhydrite	81	1,208	
Rock salt, 4th bed	15	1,223	
Dolomite and anhydrite	7	1,230	
Rock salt, 5th bed	13	1,243	
Marls, soft with anhydrite	135	1,378	
Rock salt, 6th bed	6	1,384	
Marls, soft with dolomite and anhydrite	132	1,516	
A record of a second well at Goderich is as follows (Geol. Sur. Can., Vol. V, Part II, p. 55Q):			
Blue clay, limestone boulders	100	100	
Limestone boulders and gravel	40	140	
Sandstone and limestone, alternate beds	510	650	
Hard flinty limestone	300	950	
Blue shale, thin streaks of red shale	84	1,034	
Gypsum	6	1,040	
Brown limestone, soft	14	1,054	
Rock salt, 1st bed	19	1,073	
Brown limestone, very hard	30	1,103	
Rock salt, 2nd bed	24	1,127	
Blue shales and clays	3	1,130	
Rock salt, 3rd bed	32	1,162	
Brown limestone	8	1,170	
Wingham; East Wawanosh tp., l. 41, con. XIII (Geol. Sur. Can., Vol. V, Part II, p. 56Q):			
Surface	96	96	
Grey limestone	100	196	
Dolomite	250	446	
Dolomite, with gypsum and limestone	275	721	
Limestone, with blue shale and dolomite	369	1,090	
Rock salt	30	1,120	
Limestone	65	1,185	
Top of well 1,012 feet above tide.			
Brussels (Geol. Sur. Can., Vol. V, Part II, 56Q):			
Surface	16	16	1,200 Oil and Gas
Limestone	100	116	
Limestone, magnesian	266	382	
Limestone, with chert	180	562	
"Soapstone"	353	915	
Dolomite, grey	97	1,012	
Dolomite	168	1,180	
Sandstone	64	1,244	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Huron County—Continued			
The first limestone is probably Corniferous age, beneath which is found the Onondaga series of magnesian limestones, dolomites and shales, and the sandstone—so-called—is, in all probability, referable to the Guelph series of dolomites which are usually light to dark brown and arenaceous in appearance.			
Traces of oil and gas at 1,200 feet.			
Top of well 1,120 feet above tide.			
Blyth (Geol. Sur. Can., Vol. V, Part II, p. 57Q):			
Surface	104	104	850 Gas
Limestone	300	404	
?	346	750	
Black shale	100	850	
Hard rock	170	1,020	
Shale	105	1,125	
Rock salt	90	1,215	
Top of well 1,080 feet above tide.			
Clinton (Geol. Sur. Can., Vol. V, Part II, p. 57Q):			
Surface	67	67	
Limestone	413	480	
Limestone, cherty, and dolomite	204	684	
Limestone	176	860	
Limestone, cherty, and dolomite	36	896	
Shale, limestone, gypsum and marls	255	1,151	
Rock salt, 1st bed	15	1,166	
Shale, gypsum and salt	48	1,214	
Rock salt, 2nd bed	25	1,239	
Top of well 927 feet above tide.			
Seaforth (Geol. Sur. Can., Vol. V, Part II, p. 58Q):			
Surface	25	25	
Dark grey limestone	400	425	
Magnesian limestone, with chert	310	735	
Shales, limestones and marls	250	985	
Gypsum, salt and shale	50	1,035	
Rock salt	100	1,135	
Top of well 1,009 feet above tide.			
Hensall (Geol. Sur. Can., Vol. V, Part II, p. 58Q):			
Surface	88	88	
Limestone, hard	150	238	
Limestone, soft	75	313	
Dolomite	25	338	
Limestone (magnesian?)	462	800	
Shale	230	1,030	
Marly shale	60	1,090	
Salt and shale	116	1,206	
Top of well 900 feet above tide.			
Brant County			
Brantford, Waterous Engine Co., Dalhousie St. (Geol. Sur. Can., Vol. V, Part II, p. 43Q):			
Surface	63	63	
Lower beds Onondaga and Guelph, Niagara and Clinton, if present.			
Limestone, etc.	457	520	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Brant County—Continued			
Medina			
Blue shale	5	525	
Red shale	25	550	
Sandstone	40	590	
Red shale	460	1,050	
Dark red and blue shale	68	1,118	
An imperfect record of this well was obtained.			
Top of well 707 feet above tide.			
Paris (Geol. Sur. Can., Vol. V, Part II, p. 44Q):			
Surface	10	10	
Onondaga			
Limestone	146	156	
Guelph			
Dolomite	99	255	
Cathcart, S.W. of Paris (Geol. Sur. Can., Vol. V, Part II, p. 45Q):			
Clay	140	140	
Shale and gypsum	260	400	
Brantford, Cockshutt property (Ont. Bur. Mines, Vol. XIV, Part I, p. 106):			
Surface			
Sandy loam	7	7	512 Gas
Wash gravel	3	10	Oil
Clay	40	50	
Quicksand	21	71	
Hard pan	11	82	
Guelph and Niagara			
Limestone, etc.	283	365	
Niagara			
Black shales	45	410	
Clinton			
Dolomite	12	422	
Medina			
Red shales	45	467	
Grey shales	45	512	
Sandstone	20	532	
Red shales	88	620	
Brantford, drilled by Shapley & Muir Co., Wellington St. (Ont. Bur. Mines, Vol. XIV, Part I, p. 107):			
Surface	61	61	610 Gas
Guelph and Niagara			
Limestone	299	360	
Niagara			
Black shales	45	405	
Clinton			
Dolomite	20	425	
Medina			
Red sandstone	35	460	
Blue shales	30	490	
Sand rock	15	505	
White sandstone	10	515	
Red shales	155	670	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Brant County—Continued			
Brantford, two miles southeast of Bow Park farm, Well No. 4 (Ont. Bur. Mines, Vol. XIV, Part I, p. 107):			
Surface	72	72	420 Gas
Onondaga, Guelph and Niagara			530 ,,
Limestone, etc.	293	365	542 Oil
Niagara			
Black shales	50	415	
Clinton			
Dolomite	15	430	
Medina			
Red shales	45	475	
Blue shales	30	505	
Grey sand (hard)	20	525	
White sandstone	7	532	
Red shales	92	624	
Brantford (Ont. Bur. Mines, Vol. XV, Part I, p. 112):			
Surface deposits	45	45	A little Gas
Onondaga, Guelph and Niagara, Clinton			on top of
Limestones, dolomites and shales	370	415	Trenton
Medina			
Red sandstone, red and blue shales and white sandstone	100	515	
Medina, Hudson River, Utica			
Red, blue and black shales	1,435	1,950	
Trenton			
Limestone	210	2,160	
Top of well about 730 feet above sea level.			
Brantford, Bow Park farm, Well No. 7 (Ont. Bur. Mines, Vol. XIV, Part I, p. 107):			
Surface	45	45	479 Small
Onondaga, Guelph and Niagara			flow of Gas
Limestone	276	321	
Niagara			
Black shales	45	366	
Clinton			
Dolomite	15	381	
Medina			
Red shales	30	411	
Blue shales	35	446	
Grey sand	25	471	
White sandstone	10	481	
Red shales	135	616	
Other wells drilled on Bow Park farm present somewhat similar logs.			
Onondaga tp., l. 5, con. I (W. J. Aikens):			
Surface	72	72	Small flow
Limestone and shale	71	143	of Gas in
Niagara limestone	205	348	Clinton
Shale	30	378	
Clinton limestone	25	403	
Red Medina	35	438	
Grey shale	50	488	
White Medina	12	500	
Red shale	600	1,100	
Grey shale	675	1,775	
Utica black shale	125	1,900	
Trenton limestone	695	2,595	
Potsdam sand	30	2,625	
Granite			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Waterloo County			
Waterloo (Geol. Sur. Can., Vol. V, Part II, p. 41Q):			
Surface	130	130	
Onondaga			
Limestone	40	170	
Gypsum	17	187	
Shale	20	207	
Guelph, Niagara, Clinton			
Limestone	340	547	
Clinton and Medina			
Blue shale	114	661	
Medina			
Red shale	459	1,120	
Top of well 800 feet above tide. A well in Waterloo, presumably this one, was afterwards deepened to 1,800 feet, but the record is not available.			
Berlin (Geol. Sur. Can., Vol. V, Part II, p. 42Q):			
Surface	187	187	
Limestone	320	507	
"Hard rock"	40	547	
Limestone	200	747	
Red shale	180	927	
Green shale	160	1,087	
Blue shale	170	1,257	
Top of well 1,080 feet above tide. The drilling probably began in the Onondaga formation and terminated in the Medina.			
Wellington County			
Pilkington tp., l. 6, con. V (Ont. Bur. Mines, Vol. XV, Part I, p. 110):			
Surface deposits	103	103	2,335 Gas
Onondaga			
Dolomite and limestone	252	355	
Guelph and Niagara			
Light coloured and yellow limestone and dolomite.	215	570	
Shales, red 1st 5 feet	30	600	
Clinton			
Hard limestone	42	642	
Medina			
Red shale	393	1,035	
Hudson River			
Light blue shale	565	1,600	
Utica			
Black shales	85	1,685	
Trenton			
Limestone	695	2,380	
Calciferous			
Arkose sandstone	5	2,385	
Top of well 1,375 feet above sea level.			
Peel tp., l. 5, con. III (Ont. Bur. Mines, Vol. XV, Part I, p. 110):			
Surface deposits			2,506 Gas
Gravel with pieces of limestone	35	35	
Onondaga			
Dolomite and limestone	517	552	
Guelph and Niagara			
Dolomite and limestone	220	772	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Wellington County—Continued			
Niagara			
Shales	30	802	
Clinton			
Limestone	29	831	
Medina			
Red shales	367	1,198	
Hudson River			
Drab and blue shales	572	1,770	
Utica			
Dark shales	47	1,817	
Trenton			
Limestone	705	2,522	
Calciferous			
Very hard, pink sandstone	51	2,573	
Hole ended probably in granite.			
Top of well 1,245 feet above sea level.			
Erin (Geol. Sur. Can., Vol. V, Part II, p. 43Q):			
Niagara			
Limestone	95	95	
Clinton			
Shale	100	195	
Medina			
Blue shale and sand	25	220	
Red shale	480	700	
Hudson River			
Blue shale	100	800	
Top of well 1,038 feet above tide.			
Eden Mills, l. 1, con. I, Eramosa tp. (Geol. Sur. Can., Vol. V, Part II, p. 43Q):			
Limestone and shales	159	159	
"Red strata" (Medina)	350	509	
Perth County			
Stratford (Ont. Bur. Mines, Vol. XV, Part I, p. 110):			
Surface deposits	143	143	
Onondaga, Guelph, Niagara, Clinton			
Limestones and dolomites	1,159	1,302	
Medina, Hudson River, Utica			
Red, blue and black shales	1,044	2,346	
Trenton			
Limestones	40	2,386	
Top of well 1,180 feet above sea level.			
Stratford (Geol. Sur. Can., Vol. V, Part II, p. 60Q):			
Depth of well 2,386 feet. Trenton limestone was met with at 2,360 feet.			
Dublin (Geol. Sur. Can., Vol. V, Part II, p. 60Q):			
Depth of well 1,396 feet; surface deposits 75 feet; limestone 520 feet thick occurred below the surface deposits. At 600 feet gypso-saliferous marls were met with, after passing through which the Niagara limestone was reached.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Perth County—Continued			
Mitchell (Geol. Sur. Can., Vol. V, Part II, p. 60Q): Depth of well 2,008 feet; after passing through shales belonging to the base of the Onondaga formation, the Niagara limestone was reached, and at 1,570 feet, red shale 300 feet thick, belonging to the Medina formation.			
Listowel (Geol. Sur. Can., Vol. V, Part II, p. 60Q): Depth of well 1,200 feet.			
St. Marys (Geol. Sur. Can., Vol. V, Part II, p. 60Q): Depth of well 700 feet, at which point small traces of petroleum were said to have been observed. The bore was begun on the Corniferous limestone; specimens between 100 and 500 feet were magnesian limestone.			
Middlesex County			
Glencoe (Geol. Sur. Can., Vol. V, Part II, p. 51Q):			
Surface	134	134	
Hamilton	100	234	
Limestone	162	396	
"Soapstone"	80	476	
Limestone, white			
Corniferous and Onondaga, probably 200 feet of Corniferous			
Limestone	486	962	
Onondaga			
Sandstone	38	1,000	
Hard limestone	260	1,260	
Gypsum	5	1,265	
"Hard rock"	15	1,280	
Gypsum	3	1,283	
"Hard rock"	7	1,290	
Salt and shale	104	1,394	
"Hard rock"	116	1,510	
The term "hard rock" means dolomite, and "soapstone" shale.			
Metcalfe tp., l. 24, con. XIII (Geol. Sur. Can., Vol. V, Part II, p. 52Q):			
Clay	48	48	
Portage			
Black shale	75	123	
Hamilton			
"Soapstone," etc.	273	396	
Corniferous			
Limestone	104	500	
Mosa tp., l. 5, con. VII (Geol. Sur. Can., Vol. V, Part II, p. 52Q):			
Clay	50	50	
Portage			
Black shale	10	60	
Hamilton			
"Soapstone," etc.	230	290	
Corniferous			
Limestone	262	552	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Middlesex County—Continued			
Mosa tp., l. 3, con. IV (Geol. Sur. Can., Vol. V, Part II, p. 52Q):			
Clay	88	88	
Portage Black shale	6	94	
Hamilton "Soapstone," etc.	243	337	
Corniferous Limestone	177	514	
London Insane Asylum (Geol. Sur. Can., Vol. V, Part II, p. 49Q):			
Surface	130	130	
Corniferous Limestone, hard	200	330	
Onondaga with Guelph and Niagara, if present	270	600	
Limestone, soft	100	700	
Limestone, hard	600	1,300	
Limestone	100	1,400	
Salt and shale			
Clinton Black shale	200	1,600	
Medina Red shale	500	2,100	
Hudson River Limestone and shale	150	2,250	
Top of well 880 feet above tide.			
London Sulphur spring (Geol. Sur. Can., Vol. V, Part II, p. 50Q):			
Clay	70	70	
Soft grey shale and bituminous shale	20	90	
Limestone	600	690	
Soft magnesian marl	75	765	
The rocks drilled through include the Hamilton, Corniferous and Onondaga formations.			
London tp., l. 13, con. IV (Geol. Sur. Can., Vol. V, Part II, p. 50Q):			
Clay	113	113	
Limestone, shale	400	513	
Strathroy, Adelaide tp., l. 20, con. V (Geol. Sur. Can., Vol. V, Part II, p. 51Q):			
Surface	100	100	
Hamilton Soft shale	50	150	
Corniferous Hard limestone	150	300	
Parkhill (Geol. Sur. Can., Vol. V, Part II, p. 52Q):			
Depth of well 1,300 feet. Formations traversed include two salt beds. Surface deposits were 170 ft. thick and were underlain immediately by limestone.			
Ailsa Craig, on G. T. Ry. (Geol. Sur. Can., Vol. V, Part II, p. 53Q):			
Clay	75	75	275 Oil

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Middlesex County—Continued			
Hamilton			
Limestone, soft	185	260	
Limestone	113	373	
Well near above showed:			
Surface	65	65	
Hamilton			
Limestone	5	70	
"Soapstone"	6	76	
Limestone	80	156	
"Soapstone"	50	206	
Limestone	144	350	
Biddulph tp., about 5 miles northeast of Lucan (Geol. Sur. Can., Vol. V, p. 53Q): Depth of well 360 feet; surface deposits 100 feet; limestone (probably Corniferous), 260 feet.			
Sylvan, West Williams tp., l. 15, con. XV (Geol. Sur. Can., Vol. V, Part II, p. 53Q): Depth of well 200 feet; surface deposits 175 feet; gas at 180 and 195 feet.			
Oxford County			
Tillsonburg (Geol. Sur. Can., Vol. V, Part II, p. 46Q):			
Surface	36	36	
Corniferous			
Limestone	160	196	
Onondaga			
Dolomites and limestones	694	890	
Red marl	35	925	
?			
Dark shale	825	1,750	
Other wells have been drilled in Dereham and adjoining tps., having depths of 200 to 500 feet. Small quantities of oil and gas were found, but the logs of the wells are not recorded.			
Burgessville (Geol. Sur. Can., Vol. V, Part II, p. 47Q): Depth of well, 605 feet. Surface deposits 165 feet. Specimen from 280 feet, light blue shale. " " 300 " " " with gypsum. " " 367 " cream-coloured dolomite. " " 400 " light brown dolomite. " " 550 " dark blue shale. These specimens probably belong to the Onondaga formation.			
Norwich (Geol. Sur. Can., Vol. V, Part II, p. 47Q): One well drilled to 2,000 feet; no record. A second well drilled to 500 feet gave small flow of oil at 150 feet. Surface deposits 80 feet in second well.			
Dereham tp., near Tillsonburg (Geol. Sur. Can., Vol. V, Part II, p. 45Q):			
Clay	30	30	55 Oil
Corniferous			
Limestone	96	126	68 Oil & Gas

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Oxford County—Continued			
*Beachville. Furnished by W. R. Rogers. South half l. 18, con. II, North Oxford tp., one mile west of village:			
Surface deposits	8	8	
Corniferous			
Limestone, grey, blue and light brown	232	240	
Onondaga			
Dark coloured limestone or dolomite, gypsum and blue shales	500	740	
Guelph and Niagara			
Dolomite, grey, light, brown and blue	226	966	
Niagara			
Soft blue shales	34	1,000	
Clinton			
Light brown dolomite	25	1,025	
Medina			
Blue to greenish and soft shale	65	1,090	
Calcareous sandstone	35	1,125	
Red shales	440	1,565	
Hudson River			
Blue shales	610	2,175	
Utica			
Black bituminous shales	85	2,260	
Trenton			
Limestone, light brown to whitish	529	2,789	
Granite at 2,789.			
Top of well 893 feet above sea level.			
Halton County			
Milton, Trafalgar tp., l. 10, con. I (Geol. Sur. Can., Vol. V, Part II, p. 30Q):			
Soil	47	47	
Red shale	200	247	
Blue shale	159	406	
Trafalgar tp., new survey, east half l. 15, con. I (W. I. Dick, County Crown Attorney, Milton, Ont.).			
Red Medina	285	285	1,447 Oil
Hudson River shale	795	1,080	
Utica shale	120	1,200	
Trenton	265	1,465	
Esquesing tp., west half l. 2, con. II (W. I. Dick, County Crown Attorney, Milton, Ont.):			
Gravel	40	40	
Medina sand	166	206	
Hudson shale	728	934	
Utica shale	114	1,048	
Nassagaweya tp., east half of l. 3, con. VII (R. Boyd):			
Sand and gravel	73	73	368 Gas
Red Medina shale	217	290	
White Medina shale	69	359	
"Sand"	9	368	
Another well was drilled about 1,000 feet west of this well; the record of it is as follows:			
Sand and gravel	63	63	1,710 Gas
Red Medina shale	240	303	1,725 ,,
White Medina shale	15	318	5,000 cu. ft. daily

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Halton County—Continued			
Hudson shale	835	1,153	
Trenton	667	1,820	
Slate	5	1,825	
Pre-Cambrian			
Red granite or gneiss	30	1,855	
Coarse-grained mica schist	45	1,900	
Wentworth County			
Hamilton, off Clyde Avenue West (Ont. Bur. Mines, Vol. XV, Part I, p. 112):			
Medina, Hudson River, Utica.			
Red, blue and black shales	1,250	1,250	
Trenton			
Limestone	710	1,960	
Bottom of well in pre-Cambrian at 1,960 feet.			
Top of well 290 feet above sea level.			
Flamborough East tp., l. 8, con. VIII (Geol. Sur. Can., Vol. V, Part II, p. 30Q):	....	465	340 Oil
Note.—The drilling was begun in either the base of the Guelph or summit of the Niagara formation, the whole of which, with the underlying Clinton, was probably traversed. The boring at 465 feet was in the Medina formation. Small quantity of oil is said to have been obtained at 340 feet.			
Barton tp., l. 17, con. V (Geol. Sur. Can., Vol. V, Part II, p. 31Q):			
Surface	14	14	
Niagara and Clinton			
Limestone	70	84	
Sandstone	7	91	
Medina			
Red shale	634	725	
Hudson River and Utica, with probably the lower part of Medina			
Blue shale	593	1,318	
Top of well 300 feet above Lake Ontario.			
Hamilton, Royal Hotel (Geol. Sur. Can., Vol. V, Part II, p. 31Q):			
Depth of well	....	1,000	
No record of well is available.			
Dundas, in the valley below the railway station (Geol. Sur. Can., Vol. V, Part II, p. 31Q):			
Surface	80	80	
Red shale	400	480	
Blue shale	550	1,030	
Black shale	400	1,430	
Limestone	220	1,650	
The rocks penetrated include the Medina, Hudson River and Utica and Trenton formations. Small quantities of gas were met with at various points.			
Barton tp., lot 11, con. VII (Geol. Sur. Can., Vol. V, Part II, p. 32Q):			
Niagara and Clinton			
Limestone with a little shale	250	250	700 Oil
White sandstone	5	255	780 "

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Wentworth County—Continued			
Medina			
Red shales with bluish bands	595	850	
Hudson River?			
Bluish and greyish shales	23	873	
Small quantities of oil were obtained at 700 and 780 ft.			
Mount Albion (Geol. Sur. Can., Vol. V, Part II, p. 32Q):			
Depth of well		1,500	
Lincoln County			
St. Catharines, near, l. 4, con. III, Louth tp. (Geol. Sur. Can., Vol. V, Part II, p. 32Q):			
Surface	90	90	275 Gas 2,185 ,,
Medina			
Red shale	548	638	
Hudson River and Utica			
Blue shale	700	1,338	
Black to blue shale	168	1,506	
Trenton			
Limestone	667	2,173	
White quartzose sandstone	27	2,200	
Top of well 297 feet above mean tide level.			
A small pocket of gas was opened at 275 feet in the Medina. At 2,185 feet a flow of about 4,000 cubic feet per day was obtained.			
Welland County			
Thorold (Geol. Sur. Can., Vol. V, Part II, p. 33Q):			
Surface	43	43	2,430 Gas
Clinton			
Dark brown sandstone	7	50	
Shale	70	120	
Medina			
Red sandstone	30	150	
Shale	57	207	
Grey sandstone	30	237	
Shale	813	1,050	
Hudson River			
Shale	700	1,750	
Utica			
Shale	155	1,905	
Trenton			
Limestone	525	2,430	
Top of well 517 feet above tide.			
A very small flow of gas was met with at 2,430 feet.			
Thorold (Ont. Bur. Mines, Vol. XV, Part I. p. 113):			
Surface deposits	43	43	2,400 a little Gas
Niagara			
Limestones and shales	52	95	
Clinton			
Limestone	30	125	
Medina			
Red sandstone and shales	82	207	
Grey sandstone	30	237	
Red shales	658	895	
Hudson River and Utica			
Dark blue and black shales	905	1,800	
Trenton			
Light and dark limestone	683	2,483	
Top of well about 500 feet above sea level.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
Willoughby tp., l. 4, con. III (Ont. Bur. Mines, Vol. XV, Part I, p. 113):			
Surface deposits			
Clay and gravel, drift	61	61	2,998 Gas 3,003 ,,
Onondaga			
Dolomites	135	196	
Guelph and Niagara			
Dolomites	227	423	
Niagara			
Dark shales	50	473	
Clinton			
White limestone	30	503	
Medina			
Red sandstone and shales	91	594	
White sandstone	20	614	
Red shales	915	1,529	
Hudson River and Utica			
Blue and black shales at bottom	784	2,313	
Trenton			
Limestone	685	2,998	
Calciferous			
Sandstone	32	3,030	
Pre-Cambrian granite	2	3,032	
Top of well 590 feet above sea level.			
Willoughby tp., l. 2, con. IV (Jour. Can. Min. Inst., Vol. III, p. 77):			
Surface			
Clay	18	18	495 Gas 2,940 ..
Onondaga			
Dolomites and shales with gypsum	202	220	
Guelph and Niagara			
Grey dolomite	220	440	
Niagara			
Blue shales	50	490	
Clinton			
White limestones	30	520	
Medina			
Red sandstones and shales	73	593	
White sandstone	10	603	
Blue shale	12	615	
White sandstone	18	633	
Red shales	830	1,463	
Hudson River			
Blue shales	717	2,180	
Utica			
Black shales	160	2,340	
Trenton			
White and grey limestones	670	3,010	
Calciferous			
Grey coarse sandstone	19	3,029	
Pre-Cambrian			
White quartz	1	3,030	
Willoughby tp., l. 4, con. V (Geol. Sur. Can., Vol. XIV, p. 164A):			
Depth of well 3,032 feet. Drilling stopped at what was supposed to be the Calciferous formation. The Clinton formation was reached at 473 feet from the surface, and the Medina at 594 feet;			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
the base of the Medina at 614 feet and the summit of the Trenton at 2,313 feet. From the base of the Medina to the summit of the Trenton the rocks seemed to be all shales.			
Welland, ¼ mile S.E. of (Ont. Bur. Mines, Vol. I, p. 136):			
Surface	113	113	512 light
Soft slate	107	220	flow of Gas
Hard limestone	210	430	
Slate or shale	50	480	
Clinton limestone	20	500	
Red Medina sandstone	52	552	
Slate or shale	25	577	
White Medina sandstone	20	597	
Red shale	115	712	
Welland, ½ mile S. of above. (Ont. Bur. Mines, Vol. I. p. 136; see also, Geol. Sur. Can., Vol. VI, p. 108S):			
Surface	112	112	
Onondaga, Guelph and Niagara			
Slate or shale	118	230	
Limestone	240	470	
Slate or shale	50	520	
Clinton			
Clinton limestone	13	533	
Medina			
Red Medina sandstone	45	578	
Slate or shale	25	603	
White Medina sandstone	20	623	
Red shale	82	705	
Welland (Geol. Sur. Can., Vol. VI, p. 108S):			300 small
Surface deposits	110	110	Gas
Onondaga, Guelph and Niagara			512 ,,
Shale	80	190	
Limestone	225	415	
Shale, blue	65	480	
Clinton			
Limestone	20	500	
Shale	5	505	
Medina			
Red sandstone	55	560	
Shale	10	570	
White sandstone	5	575	
Shale	20	595	
White sandstone	20	615	
Red shale	97	712	
Bertie tp., l. 35, con. III (Jour. Can. Min. Inst., Vol. III, p. 75):			
Soil	2	2	836 Gas
Corniferous			
Dark grey limestone	23	25	
Onondaga			
Grey and drab dolomites and black shales with gypsum	390	415	
Guelph and Niagara			
Grey dolomites	240	655	
Niagara			
Blue shales	50	705	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
Clinton			
White crystalline limestones, grey and shaly towards bottom	30	735	
Medina			
Red sandstone	55	790	
Red shale	10	800	
Blue shale	8	808	
White sandstone	5	813	
Blue shale	20	833	
White sandstone	13	846	
Point Abino, Bertie tp. (Jour. Can. Min. Inst., Vol. III, p. 76):			500 Gas in 530 large 580 quantities
Surface			
Sand	10	10	
Corniferous			
Grey limestones with flint	82	92	902 Gas
Onondaga			
Grey and drab dolomite, blue shales and gypsum.	288	380	
Guelph and Niagara			
Grey dolomites	235	715	
Niagara			
Blue shales	55	770	
Clinton			
White sandstone	30	800	
Medina			
Red sandstone	80	880	
Blue shale	13	893	
White sandstone	17	910	
Bertie tp., l. 35, con. III (Geol. Sur. Can., Vol. V, Part II, p. 37Q):			
Surface	2	2	836 Gas
Corniferous			
Dark grey limestone	23	25	
Onondaga			
Grey and drab dolomites, black shales and gypsum	390	415	
Guelph and Niagara			
Grey dolomite	240	655	
Niagara			
Black shales	50	705	
Clinton			
White crystalline dolomite, grey towards bottom.	30	735	
Medina			
Red sandstone	55	790	
Red shales	10	800	
Blue shales	5	805	
White sandstone	5	810	
Blue shale	20	830	
White sandstone "Gas rock"	16	846	

Top of well is 618 feet above tide level. Gas to the extent of 1,000,000 cubic feet per day was met with at 836 feet in the Medina. When the well was shot the flow increased to 2,050,000 cubic feet per day. This well is one of thirteen which were drilled by the Provincial Natural Gas and Fuel Company up to the end of the year 1890. The logs of the other twelve wells are almost identical with the one given above. The following table shows the capacity of the wells at that time:

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
Cub. feet			
No. 1 well 2,050,000			
" 2 " 375,000			
" 3 " 600,000			
" 4 " 2,200,000			
" 5 " 8,500,000			
" 6 " 70,000			
" 7 " 3,000,000			
" 9 " 3,500,000			
" 10 " 4,500,000			
" 11 " 300,000			
" 12 " 5,500,000			
" 13 " 300,000			
Bertie tp., l. 6, can. XV (Jour. Can. Min. Inst., Vol. III, p. 76):			
Surface			
Clay	38	38	743 Gas
Onondaga			
Dolomites, grey and drab, black shale and gypsum	300	338	
Guelph and Niagara			
Grey dolomite	230	568	
Niagara			
Blue shales	60	628	
Clinton			
White and grey limestones	32	660	
Medina			
Red sandstone	83	743	
Blue shale	15	758	
White sandstone	16	774	
Red shales	850	1,624	
Hudson River			
Blue shales	730	2,354	
Utica			
Black shales	171	2,525	
Trenton			
White and grey limestone	685	3,210	
Calciferous			
Yellowish sandstone	45	3,255	
Pre-Cambrian			
Mica schist	2	3,257	
Bertie tp., l. 35, con. III (Ont. Bur. Mines, Vol. I, p. 133):			
Surface deposits	3	3	846 Gas
Corniferous			
Limestone	77	80	
Onondaga			
Limestone and shale, with gypsum..........	345	425	
Guelph and Niagara			
Limestone	225	650	
Niagara			
Black shales	55	705	
Clinton			
White and grey limestone	30	735	
Medina			
Sandstone and shale	115	850	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
Ridgeway (Ont. Bur. Mines, Vol. I, p. 135; see also Geol. Sur. Can., Vol. VI, p. 107S):			
Corniferous			725 Gas
Flinty limestone	60	60	785 ,,
			840 ,,
Onondaga, Guelph and Niagara			to 850 ,,
Shale and gypsum	90	150	
Hard shale	5	155	
Shaly rock	30	185	
Slate and gypsum	15	200	
Slate and shale	230	430	
Limestone	115	545	
Siliceous limestone	15	560	
Hard limestone	110	670	
Slate	50	720	
Clinton			
Clinton limestone	10	730	
Shale	10	740	
Medina			
Red Medina sandstone	70	810	
Sandstone	5	815	
Light coloured sandstone	5	820	
Dark shale	20	840	
White Medina sandstone	12	852	
Red shale	18	870	
Port Colborne (Geol. Sur. Can., Vol. V, Part II, pp. 34Q-35Q):			
Well No. 1			
Surface	12	12	150 Small
Corniferous			252 flows
Grey limestone	13	25	415 of Gas
Onondaga and Lower Helderberg			
Grey limestone	7	32	764 Main flow of Gas
Dolomite	3	35	
Shale and dolomite	55	90	
Dolomite and gypsum	57	147	
Dolomite	108	255	
Shales and dolomite with gypsum	185	440	
Guelph and Niagara			
Shaly dolomite	30	470	
Brown dolomite and dark blue shales towards bottom	188	658	
Clinton			
Marls and dolomite	72	730	
Medina			
Red shales with thin bands of white sandstone	50	780	
Red and white sandstone	53	833	
Soft red shales with bands of grey and green.	667	1,500	
The main flow of gas was met with at 764 feet and afforded 25,000 cubic feet per day.			
Well No. 2			
This well reached a depth of 770 feet, being then in the red shales of the upper part of the Medina. Gas was met with at 762 feet and afforded 25,000 cubic feet per day.	....	770	762 Gas
Well No. 3			
This well reached a depth of 771 feet; gas was met with at 765 feet.	....	771	765 Gas

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
Port Colborne			
Surface clay	12	12	
Salina			
Limestone and shales	473	485	
Niagara			
Limestone	155	640	
Shales	70	710	
Clinton			
Limestones and shales	50	760	
Medina			
Sandstone and shales	740	1,500	
Port Colborne (Ont. Bur. Mines, Vol. I, p. 129):			
Drift	12	12	
Corniferous			
Limestone	13	25	
Onondaga limestone	7	32	
Lower Helderberg			
Fair cement rock	3	35	
Salina			
Shale and cement rock	17	52	
Dark shale	8	60	
Shale and cement rock	30	90	
Gypsum and shale	10	100	
Shale	7	107	
Gypsum and shale	40	147	
Shale	5	152	
Shaly limestone	28	180	
Drab coloured limestone	6	186	
Shaly limestone	4	190	
Gypsum and shaly limestone, with transparent particles of selenite (?)	112	302	
Magnesian limestone	198	500	
Shaly limestone	200	700	
Clinton			
Clinton limestone	20	720	
Clinton shale	10	730	
Medina			
Red shale, soft at first but gradually becoming harder	20	750	
Red sandstone, mottled	30	780	
Sandstone, red and white	53	833	
Soft red shale, with bands of grey and green	667	1,500	
Niagara Falls South, lot 158, Stamford tp. (Geol. Sur. Can., Vol. V, Part II, p. 36Q):			
Well No. 1			
Surface	43	43	215 Gas
Niagara			
Limestone	143	186	
Shale	24	210	
Clinton			
Shale	140	350	
Medina			
White quartzose sandstone	24	374	
Shale and sandstone	466	840	
Gas was met at 215 feet in the upper beds of the Clinton; daily flow, 4,000 cubic feet.			
Well No. 2, immediately south of No. 1, lot 172, Stamford tp.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
This well was drilled to a depth of 1,000 feet. Gas in similar quantity to No. 1 was found at 380 feet, presumably in the upper sandy strata of the Medina formation.			
Crowland tp., l. 12, con. VI (Ont. Bur. Mines, Vol. XIV, Part I, p. 104):			
Surface	120	120	538 Gas
Onondaga			
Dolomites and shales	120	240	
Guelph and Niagara			
Grey dolomites	233	473	
Niagara			
Blue shales	55	528	
Clinton			
White sandstone	30	558	
Medina			
Red sandstones and shales	61	619	
White sandstone	12	631	
Blue shales	11	642	
White sandstone	18	660	
Wainfleet tp., l. 6, con. I (Reek well) (Geol. Sur. Can., Vol. V, Part II, p. 40Q-41Q):			
Onondaga			
Drab and grey dolomites, shales and gypsum	390	390	685 Gas
Guelph and Niagara			
Grey dolomite	240	630	
Niagara			
Black shale	55	685	
Clinton			
Dolomite	30	715	
Medina			
Red sandstone	45	760	
Red and blue shale	40	800	
White sandstone	20	820	
Gas was met at 685 feet at the summit of the Clinton dolomite; 400,000 cubic feet per day.			
In Vol. I, Ont. Bur. Mines, another log, apparently of the same well, is given. The two do not agree.			
Surface	2	2	685 Gas
Corniferous			
Limestone	16	18	
Lower Helderberg			
Limestone	5	23	
Cement rock and shale	7	30	
Onondaga			
Impure limestone with shale and gypsum	390	420	
Niagara			
Limestone	185	605	
Shale	79	684	
Clinton			
Limestone and shale	30	714	
Medina			
"Mottled" stone	46	760	
Shaly sandstone	40	800	
White sandstone	23	823	
Shale	31	854	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Welland County—Continued			
Wainfleet tp., l. 31, con. V, well No. 4 (Bur. Mines, Vol. XIV, Part I, p. 104):			
Surface	144	144	640 Gas
Onondaga			
Limestone and shale	171	315	
Guelph and Niagara			
Grey dolomite	160	475	
Niagara			
Blue shales	45	520	
Clinton			
White limestone	35	555	
Medina			
Red sandstone	60	615	
Grey shales	25	640	
White sandstone	22	662	
Humberstone (Ont. Bur. Mines, Vol. XIV, Part I, p. 101; see also, ibid., p. 130):			
Limestone outcrops at the surface and has a total depth of 700 feet. At 683 feet the Clinton formation was reached and 10 feet of that rock yielded gas. Red Medina sandstone occurred from 713 to 760, followed by 10 feet of shale; gas "sand" from 770 to 780; slate from 780 to 815; white Medina from 815 to 822, and thence to 847 feet red shale.			
Humberstone tp., l. 11, con. III (Geol. Sur. Can., Vol. V, Part II, p. 122SS):			
Surface deposits	63	63	761 } Oil& 764 } Gas
Onondaga			
Drab and grey dolomites	282	345	
Guelph and Niagara			
Grey dolomite	240	585	
Niagara			
Black shale	50	635	
Clinton			
White crystalline limestone	30	665	
Medina			
Red sandstone	55	720	
Red shale	10	730	
Blue shale	5	735	
White sandstone	5	740	
Blue shale	20	760	
White sandstone	22	782	
Humberstone tp., l. 9, con. II (Geol. Sur. Can., Vol. XIV, p. 165A):			
Granite was struck at 3,300 feet.			
Haldimand County			
Dunnville (Ont. Bur. Mines, Vol. I, p. 137; see also, Geol. Sur. Can., Vol. VI, p. 105S):			
Surface deposits	76	76	612 Gas
Onondaga, Guelph and Niagara			740 ,,
Brown limestone, thin layers gypsum	74	150	to752 ,,
Hard shale, with gypsum	205	355	747 ,,
Hard Niagara limestone	210	565	
Soft shale or slate	47	612	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Clinton			
Clinton limestone	24	636	
Slate or shale	4	640	
Medina			
Red Medina sandstone	45	685	
Hard shale or slate	40	725	
White Medina sandstone and shale	15	740	
White Medina sandstone	12	752	
Red shale	20	772	
Dunnville (Ont. Bur. Mines, Vol. I, p. 137; see also Geol. Sur. Can., Vol. VI, p. 105S):			
Surface deposits	70	70	
Onondaga, Guelph and Niagara:			
Limestone	80	150	
Shale and slate	190	340	
Hard limestone	227	567	
Shale or slate	45	612	
Clinton			
Clinton limestone	22	634	
Shale or slate	1	635	
Medina			
Red Medina sandstone	45	680	
Slate and shale	50	730	
White Medina sandstone	20	750	
Reddish shale	30	780	
Dunnville (Dominion Natural Gas Co., Ltd.):			
Surface	86	86	
Limestone	263	349	
Niagara limestone	208	557	
Grey shale	50	607	
Clinton	23	630	
Red Medina	48	678	
Blue shale	58	736	
White Medina	12	748	
Red shale	50	798	
Moulton tp., l. 13, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	80	80	520 Gas
Shale	210	290	
Niagara	140	430	
Shale	55	485	
Clinton	25	510	
Red Medina	37	547	
Grey shale	55	602	
White Medina	12	614	
Red shale	50	664	
Moulton tp., l. 6, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	48	48	552 Some Gas
Shale	260	308	681 More Gas
Niagara limestone	160	468	
White limestone	20	488	
Shale	60	548	
Clinton	25	573	
Red Medina	40	613	
White shale	60	673	
White Medina	15	688	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
South Cayuga tp., l. 19, con. IV (Dominion Natural Gas Co., Ltd.):			
Surface	62	62	672 } Gas
Lime and shale	338	400	705 } ,,
Niagara	200	600	
Shale	70	670	
Clinton	25	695	
Red Medina	40	735	
White shale	60	795	
White Medina	12	807	
Red shale	9	816	
North Cayuga tp., l. 35, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	18	18	670 Gas
Flint	137	155	685 a lttie Gas
Lime and shale	295	450	
Niagara	200	650	
Clinton	30	680	
Red Medina	40	720	
White shale	102	822	
North Cayuga tp., l. 35, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	22	22	
Flint	80	102	744 Gas
Lime and shale	305	407	
Niagara	243	650	
Shale	50	700	
Clinton	24	724	
Red Medina	45	769	
White shale	63	832	
White Medina	15	847	
Red shale	5	852	
North Cayuga tp., one and a half miles west of preceding well (Bur. Mines, Vol. XIV, Part I, p. 105):			
Surface	58	58	667 Gas
Onondaga			
Limestone and shale	300	358	
Guelph and Niagara			
Grey dolomite	160	518	
Niagara			
Blue shales	40	558	
Clinton			
Dolomite	15	573	
Grey shales	10	583	
Medina			
Red sandstone	40	623	
Grey shale	40	663	
White sandstone	17	680	
Red shale	110	790	
North Cayuga tp., l. 44, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	14	14	
Flint	86	100	
Lime	590	690	
Shale	50	740	
Clinton	30	770	
Red Medina	45	815	
Shale	5	820	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
North Cayuga tp., l. 1 in "Jones Tract" (Dominion Natural Gas Co., Ltd.):			
Surface	40	40	595 Gas
Lime and shale	290	330	
Niagara	235	565	
Shale	20	585	
Clinton	25	610	
Red Medina	50	660	
White shale	60	720	
White Medina	20	740	
Red shale	14	754	
North Cayuga tp., l. 22, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	25	25	
Flint	80	105	
Lime and shale	298	403	
Niagara	240	643	
Shale	49	692	
Clinton	25	717	
Red Medina	45	762	
White shale	60	822	
White Medina	13	835	
Red shale	5	840	
Cayuga, N. Cayuga tp. (Ont. Bur. Mines, Vol. I, p. 138):			
Surface deposits	23	23	
Limestone	120	143	
Shale	132	275	
Hard limestone	232	507	
Slate or shale	41	548	
Clinton limestone	15	563	
Slate or shale	5	568	
Red Medina sandstone	35	603	
Shale	62	665	
White Medina sandstone	15	680	
Red shale	30	710	
North Cayuga tp., l. 37, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	10	10	700 } Some
Flint	100	110	715 } Gas
Black lime	40	150	
Niagara shale	75	225	
Grey Niagara	225	450	
Brown Niagara	150	600	
White lime	30	630	
Black shale	51	681	
Clinton	24	705	
Red Medina	43	748	
Shale	4	752	
North Cayuga tp., l. 43, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	12	12	750 Some Gas
Flint	88	100	
Lime and shale	180	280	
Grey lime	200	480	
Niagara	160	640	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Shale	90	730	
Clinton	30	760	
Red Medina	45	805	
Shale	22	827	
North Cayuga tp., l. 36, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	20	20	
Shell rock	5	25	690 Some Gas
Flint	75	100	
Niagara	100	200	
Grey Niagara	125	325	
Brown Niagara	275	600	
White lime	25	625	
Black shale	50	675	
Clinton	25	700	
Red Medina	25	725	
Shale	55	780	
Sand rock	20	800	
White Medina	9	809	
Red shale	41	850	
Canborough tp., half mile south of Darling Road station on Wabash railway (Ont. Bur. Mines, Vol XIV, Part I, p. 105):			
Surface	56	56	665 Gas
Onondaga			
Limestone, shale, gypsum	290	346	
Guelph and Niagara			
Grey dolomite	160	506	
Niagara			
Blue shale	40	546	
Clinton			
Dolomite	18	564	
Grey shale	15	579	
Medina			
Red sandstone	40	619	
Grey shales	30	649	
White sandstone	20	669	
Red shales	56	725	
Canborough tp., l. 18, con. II (Ont. Bur. Mines, Vol. XIV, Part I, p. 105):			
Surface and Onondaga			
Clay and shales	100	100	582 Gas
Guelph and Niagara			
Shale and rock	318	418	
Niagara			
Grey shale	45	463	
Clinton			
Dolomite	23	486	
Medina			
Red sandstone	48	534	
Blue shale	48	582	
White Medina	10	592	
Red shales	26	618	
Rainham tp., l. 2, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	17	17	815 Trace of Gas

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Flint	148	165	
Lime and shale	325	490	838
Niagara	277	767	to
Shale	28	795	849 Gas
Clinton	24	819	
Red Medina	45	864	
White shale	60	924	
White Medina	18	942	
Red shale	18	960	
Rainham tp., l. 12, con. IV (Dominion Natural Gas Co., Ltd.):			
Surface	12	12	762
Flint	80	92	to
Lime and shale	305	397	767
Niagara	280	677	797 Gas
Shale	70	747	to
Clinton	25	772	802
Red Medina	50	822	
White shale	60	882	
White Medina	20	902	
Red shale	12	914	
Rainham tp., l. 19, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	7	7	727 A little Gas
Flint	100	107	757 Gas
Lime and shale	285	392	
Niagara	260	652	
Shale	65	717	
Clinton	25	742	
Red Medina	40	782	
White shale	55	837	
White Medina	8	845	
Red shale	1	846	
Rainham tp., l. 6, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	38	38	784 Gas
Flint	140	178	805 "
Lime and shale	312	490	to820 "
Niagara	240	730	
Shale	34	764	
Clinton	26	790	
Red Medina	44	834	
White shale	75	909	
White Medina	12	921	
Red shale	22	943	
Rainham tp., l. 11, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	12	12	770 Gas
Flint	140	152	815 "
Lime and shale	328	480	
Niagara	235	715	
Shale	45	760	
Clinton	30	790	
Red Medina	35	825	
White shale	60	885	
White Medina	20	905	
Red shale	4	909	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Rainham tp., l. 15, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	11	11	765 Gas; 810 "
Flint	110	121	
Lime and shale	339	460	
Niagara	205	665	
Black Niagara	45	710	
Shale	45	755	
Clinton	25	780	
Red Medina	45	825	
White shale	63	888	
White Medina	28	916	
Red shale	7	923	
Rainham tp., l. 5, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	15	15	786 A little Gas
Flint	135	150	820 to 836 Gas
Lime and shale	340	490	
Niagara	240	730	
Shale	56	786	
Clinton	24	810	
Red Medina	50	860	
White shale	60	920	
White Medina	20	940	
Red shale	15	955	
Rainham tp., l. 10, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	17	17	810 to 825 Gas
Flint	85	102	
Shale and lime	368	470	
Niagara	260	730	
Shale	45	775	
Clinton	25	800	
Red Medina	40	840	
Shale	70	910	
White Medina	18	928	
Red shale	16	944	
Rainham tp., l. 18, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	14	14	742 A little Gas
Flint	128	142	782 More Gas
Lime and shale	200	342	
Niagara	315	657	
Shale	75	732	
Clinton	30	762	
Red Medina	45	807	
Grey shale	67	874	
White Medina	8	882	
Red shale	4	886	
Rainham tp., l. 25, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	15	15	755 Some Gas
Flint	70	85	785 More Gas

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Shale	200	285	
Grey lime	115	400	
Brown Niagara lime	275	675	
Shale	65	740	
Clinton	25	765	
Red Medina	35	800	
Shale	55	855	
White Medina	8	863	
Red shale	2	865	
Rainham tp., l. 21, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	14	14	740 Very little Gas
Flint	120	134	
Brown Niagara	165	299	
Shale	216	515	
Grey limestone	20	535	
Brown Niagara	150	685	
Shale	40	725	
Clinton	30	755	
Red Medina	40	795	
White shale	50	845	
White Medina	10	855	
Red shale	2	857	
Rainham tp., l. 2, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	8	8	862 Gas
Flint	140	148	
Lime and shale	365	513	
Niagara	256	769	
Shale	36	805	
Clinton	27	832	
Red Medina	50	882	
White shale	74	956	
White Medina	18	974	
Red shale	18	992	
Rainham tp., l. 2, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	12	12	777 A little Gas
Flint	145	157	814 More Gas
Lime and shale	380	537	
Niagara	190	727	
Shale	45	772	
Clinton	20	792	
Red Medina	52	844	
Shale	90	934	
White Medina	36	970	
Red shale	32	1,002	
Rainham tp., l. 5, con. V (Dominion Natural Gas Co., Ltd.):			
Surface	8	8	750 Some Gas
Flint	112	120	790 More Gas
Lime	570	690	
Shale	55	745	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Clinton	30	775	
Red Medina	40	815	
Shale	16	831	
Rainham tp., l. 15, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	13	13	763 Gas
Flint	105	118	787 "
Lime and shale	325	443	
Niagara	250	693	
Shale	50	743	
Clinton	25	768	
Red Medina	40	808	
White shale	50	858	
White Medina	10	868	
Red shale	14	882	
Rainham tp., l. 13, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	14	14	815 to
Flint	110	124	825 Gas
Lime and shale	330	454	
Niagara	246	700	
Shale	60	760	
Clinton	30	790	
Red Medina	50	840	
White shale	60	900	
White Medina	15	915	
Red shale	8	923	
Rainham tp., l. 19, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	13	13	758
Flint	120	133	to Gas
Lime and shale	200	333	768
Niagara	302	635	
Grey lime	18	653	
Shale	65	718	
Clinton	30	748	
Red Medina	40	788	
Grey shale	55	843	
White Medina	17	860	
Red shale	5	865	
Walpole tp., l. 8, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	34	34	885
Flint	146	180	to Gas
Lime and shale	340	520	890
Niagara	300	820	
Shale	50	870	
Clinton	25	895	
Red Medina	40	935	
White shale	55	990	
White Medina	6	996	
Red shale	4	1,000	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Walpole tp., l. 22, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	5	5	785 Gas
Flint	100	105	910 to 914 Gas
Lime and shale	345	450	
Niagara	280	730	
Shale	40	770	
Clinton	20	790	
Red Medina	40	830	
White shale	75	905	
White Medina	10	915	
Red shale	15	930	
Walpole tp., l. 22, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	8	8	850 A little Gas
Flint	160	168	868 Gas
Lime and shale	440	608	
Niagara	194	802	
Shale	38	840	
Clinton	22	862	
Red Medina	33	895	
White shale	70	965	
White Medina	5	970	
Red shale	35	1,005	
Walpole tp., l. 13, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	14	14	965 to 970 Gas
Flint	125	139	
Lime and shale	391	530	
Niagara	250	780	
Shale	50	830	
Clinton	20	850	
Red Medina	40	890	
White shale	70	960	
White Medina	12	972	
Red shale	48	1,020	
Walpole tp., l. 15, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	5	5	
Flint	140	145	
Lime and shale	390	535	
Niagara	245	780	
Shale	50	830	
Clinton	24	854	
Red Medina	50	904	
White shale	60	964	
White Medina	12	976	
Red shale	8	984	
Walpole tp., l. 24, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	24	24	850 Gas
Flint	150	174	
Lime and shale	420	594	
Niagara	176	770	
Shale	40	810	
Clinton	20	830	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Haldimand County—Continued			
Red Medina	50	880	
Shale	60	940	
White Medina	20	960	
Red shale	43	1,003	
Walpole tp., l. 20, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	14	14	822 Gas
Flint	130	144	856 to 866 Gas
Lime and shale	336	480	
Niagara	292	772	
Shale	40	812	
Clinton	24	836	
Red Medina	34	870	
White shale	62	932	
White Medina	30	962	
Red shale	15	977	
Walpole tp., l. 12, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	26	26	885 Gas
Flint	125	151	
Lime and shale	379	530	
Niagara	280	810	
Shale	40	850	
Clinton	20	870	
Red Medina	35	905	
White shale	49	954	
White Medina	12	966	
Red shale	15	981	
Walpole tp., l. 11, con. V (Dominion Natural Gas Co., Ltd.):			
Surface	18	18	835 Some Gas
Flint	110	128	
Lime and shale	372	500	
Niagara	270	770	
Shale	55	825	
Clinton	15	840	
Red Medina	30	870	
White shale	50	920	
White Medina	25	945	
Red shale	5	950	
Haldimand county: Three deep wells, 2,800 feet each, were drilled in Haldimand county at Jarvis, Nelles and York, respectively, but all three were practically dry.			
Norfolk County			
Port Dover (Dominion Natural Gas Co., Ltd.):			
Surface deposits	28	28	
Probably Corniferous and Onondaga Flint	218	246	
Onondaga Lime and shale	364	610	
Probably Guelph and Niagara	280	890	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Norfolk County—Continued			
Niagara			
Shale	34	924	
Clinton	10	934	
Red Medina	40	974	
White shale, Medina	76	1,050	
White Medina	12	1,062	
Red shale	8	1,070	
Top of well 584 feet above sea level.			
Woodhouse tp., l. 9, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	32	32	1,100 Gas
Flint	240	272	
Lime and shale	350	622	
Niagara	298	920	
Shale	54	974	
Clinton	24	998	
Red Medina	15	1,013	
Shale	82	1,095	
White Medina	12	1,107	
Shale	34	1,141	
Woodhouse tp., l. 8, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	94	94	1,028 to 1,038 Gas
Flint	190	284	
Lime and shale	370	654	
Niagara lime	314	968	
Shale	46	1,014	
Clinton	12	1,026	
White Medina	28	1,054	
Shale	66	1,120	
Woodhouse tp., l. 9. con. II (Dominion Natural Gas Co., Ltd.):			
Surface	70	70	1,014 Gas
Flint	190	260	
Lime and shale	355	615	
Niagara lime	300	915	
Shale	55	970	
Clinton	12	982	
White Medina	32	1,014	
Shale	70	1,084	
Woodhouse tp., l. 7, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	31	31	965 Gas
Flint	198	229	
Shale and lime	371	600	
Niagara	300	900	
Shale	30	930	
Clinton	24	954	
Red Medina	17	971	
Shale	65	1,036	
Woodhouse tp., l. 10, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	80	80	1,000 1,085 Gas
Flint	190	270	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Norfolk County—Continued			
Lime and shale	350	620	
Niagara	300	920	
Shale	38	958	
Clinton	12	970	
Red Medina	41	1,011	
White shale	70	1,081	
White Medina	13	1,094	
Shale	45	1,139	
Woodhouse tp., l. 5, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	148	148	
Flint	210	358	
Lime and shale	392	750	
Niagara	250	1,000	
Shale	50	1,045	
Clinton	20	1,065	
Red Medina	45	1,110	
White shale	42	1,152	
Woodhouse tp., l. 6, con. I (Dominion Natural Gas Co., Ltd.):			
Surface	134	134	
Flint	191	325	
Lime and shale	360	685	
Niagara	297	982	
Shale	47	1,029	
Clinton	15	1,044	
Red Medina	35	1,079	
Shale	70	1,149	
White Medina	14	1,163	
Red shale	23	1,186	
Woodhouse tp., l. 3, cons. III and IV (Dominion Natural Gas Co., Ltd.):			
Surface	36	36	968 Gas
Flint	194	230	1,080 Show
Niagara	685	915	of Oil
Clinton	75	990	
Red Medina	2	992	
Shale	77	1,069	
White Medina	12	1,081	
Shale	50	1,131	
Woodhouse tp., l. 8, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	28	28	942 } 962 } Gas
Flint	57	85	
Lime and shale	395	580	
Niagara	305	885	
Shale	41	926	
Clinton	48	974	
Shale	60	1,034	
White Medina	12	1,046	
Red shale	15	1,061	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Norfolk County—Continued			
Woodhouse tp., l. 7, con. III (Dominion Natural Gas Co., Ltd.):			
Surface	34	34	929 } 949 } Gas
Flint	200	234	
Lime and shale	375	609	
Niagara	310	919	
Clinton	10	929	
Red Medina	20	949	
Shale	90	1,039	
White Medina	3	1,042	
Red shale	13	1,055	
Woodhouse tp., l. 3, con. II (Dominion Natural Gas Co., Ltd.):			
Surface	180	180	1,090 to 1,095 } Gas
Flint	225	405	
Lime and shale	332	737	
Niagara lime	332	1,069	
Shale	16	1,085	
Clinton	12	1,097	
Red Medina	25	1,122	
White shale	60	1,182	
White Medina	6	1,188	
*Lynedoch, Charlotteville tp.:			
Surface	195	195	Gas occurred at 18 feet below the top of the Clinton
Slate (black)	10	205	
Limestone	60	265	
Shale	140	405	
Limestone	225	630	
Shale and limestone	390	1,020	
Niagara	240	1,260	
Niagara shale	55	1,315	
Clinton limestone	21	1,336	
Red Medina	35	1,371	
Blue shale	60	1,431	
Simcoe (Geol. Sur. Can., Vol. VI, p. 104S):			
Surface deposits	98	98	
Corniferous and Onondaga			
Hard rock	102	200	
Limestone	70	270	
Shale and gypsum	70	340	
Limestone	60	400	
Shale	3	403	
Limestone	42	445	
Shale	5	450	
Limestone	95	545	
Shale	5	550	
Lower Onondaga, Guelph and Niagara			
Limestone	315	865	
Shale	80	945	
Clinton			
Limestone	45	990	
Shale	5	995	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Norfolk County—Continued			
Medina			
Red sandstone	20	1,015	
Shale	65	1,080	
White sandstone	5	1,085	
Red shale	690	1,775	
Hudson River			
White shale	625	2,400	
Utica			
Brown shale	144	2,544	
Trenton			
Limestone	158	2,702	
Vittoria, Charlotteville tp. (Dominion Natural Gas Co., Ltd.):			
Surface	137	137	Small show of Gas in Red Medina
Flint	218	355	
Sand	45	400	
Lime	70	470	
Shale and lime	250	720	
Niagara lime	300	1,020	
Shale	82	1,102	
Clinton	12	1,114	
Red Medina	16	1,130	
Shale	80	1,210	
White Medina	10	1,220	
Red slate	480	1,700	
White slate and lime	125	1,825	
Red slate	100	1,925	
White slate and lime	350	2,275	
Brown slate	415	2,690	
Trenton	392	3,082	
Big Creek, near Lynedoch (Geol. Sur. Can., Vol. V, Part II, p. 48Q): Depth of well 600 feet. Surface deposits 100 feet, below which black shales, probably of Hamilton age, were found. Small quantity of gas at 600 feet.			
*St. Williams, South Walsingham tp., l. 24, con. I:			
Surface deposits	284	284	
Probably Corniferous			
Flint	171	455	
Oriskany?			
Sand	115	570	
Probably Onondaga			
Lime and shale	330	900	
Probably Guelph and Niagara			
Niagara	320	1,220	
Niagara			
Shale	43	1,263	
Clinton			
Clinton	22	1,285	
Shale	3	1,288	
Medina			
Red Medina	22	1,310	
Shale	75	1,385	
White Medina	27	1,412	
Red shale	8	1,420	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Norfolk County—Continued			
Port Rowan (Ont. Bur. Mines, Vol. XIV, Part I, p. 108):			
Surface			
Clay	300	300	
Corniferous			
Grey limestone	63	363	
Greyish-blue limestone	77	440	
Dark brown	30	470	
Bluish grey	94	564	
Corniferous or Oriskany			
White and blue granular limestone	21	585	
Onondaga			
Greyish-blue dolomite	435	1,020	
Niagara			
White "sugary" limestone	290	1,310	
Clinton			
Drab and argillaceous	10	1,320	
Medina			
Red and blue sandstone	140	1,460	
*Delhi, Middleton tp. At the Darby hotel, near Grand Trunk railway station:			
Depth of well 1,218 feet. Top of well 756 feet above sea level. Gas in Clinton, Red and White Medina, but chief yield is from the top of the Red Medina.			
Elgin County			
Aylmer, near, Malahide tp. (Ont. Bur. Mines, Vol. XIV, Part I, p. 109):			
Surface			
Clay, sand and gravel	247	247	
Corniferous			
Limestone	169	416	
Port Stanley (Geol. Sur. Can., Vol. V, Part II, p. 49Q):			
Surface	172	172	
Hamilton			
Black and brown shale	30	202	
Light coloured shale	16	218	
Limestone	80	298	
St. Thomas (Ont. Bur. Mines, Vol. XIV, Part I, p. 108):			
A deep well was drilled here to a depth of 3,030 feet. A little gas was struck in Medina formation.			
Dunwich tp., Elginfield Oil & Gas Co. (Ont. Bur. Mines, Vol. XIV, Part I, p. 108):			
Surface	200	200	160 Oil
Hamilton			
Black shales	7	207	
Hard pan, blue clay	25	232	
Corniferous			
Limestone	170	402	
Dunwich tp., Beaver Oil Co. (Ont. Bur. Mines, Vol. XIV, Part I, p. 108):			
Surface	228	228	175 Oil
Hamilton			
Lime (grey shales)	25	253	
Corniferous			
Limestone	187	440	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Elgin County—Continued			
Dunwich tp., Beaver Oil Co. (Ont. Bur. Mines, Vol. XIV, Part I, p. 109):			
Surface	208	208	
Hamilton			
Lime (shales)	27	235	
Corniferous			
Limestone	172	407	
Dunwich tp., Beaver Oil Co. (Ont. Bur. Mines, Vol. XIV, Part I, p. 109):			
Surface	183	183	
Corniferous			
Limestone	167	350	
Vienna, Bayham tp.:			
Surface deposits	193	193	260 Some Gas
Black shale	5	198	725 Small Quantity of Gas
Flint (very hard)	280	478	
Lime (very hard)	447	925	
Niagara (very hard)	290	1,215	1309 Gas
Dark shale (soft)	70	1,285	
Clinton	22	1,307	
White Medina	23	1,330	
Red Medina (very soft)	45	1 375	
Port Burwell, ½ mile east of:			
Surface deposits	250	250	300 Oil
Black shale	45	295	725, 1225 Gas
Flint (very hard)	260	555	
Limestone (very hard)	440	995	
Niagara	280	1,275	1357 Big Gas
Dark shale	60	1,335	
Clinton	22	1,357	
Red shale (mud)	15	1,372	
White limestone	20	1.392	
White Medina	5	1,397	
Bayham tp., l. 14, con. II:			
Surface deposits	255	255	300 Gas
Black slate	20	275	1080 "
Flint	50	325	
Slate	25	350	1398 Big Gas
Lime	30	380	
Flint	300	680	1414 Show of Oil
Lime	395	1,075	
Niagara	245	1,320	
Slate	64	1,384	
Clinton	30	1,414	
Red shale	7	1,421	
*Port Burwell, Bayham tp.; on the Weaver farm, one mile west of village:			
Surface	287	287	Small Gas 13 feet in Clinton
Black shale	30	317	
Flint	280	597	
Limestone and shale	490	1,087	
Niagara limestone	270	1,357	
Niagara shale	60	1,417	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Elgin County—Continued			
Clinton limestone	26	1,443	
Red Medina, chiefly sand	25	1,468	
Blue shale	65	1,533	
White Medina sandstone	5	1,538	
Red shale	17	1,555	
Vienna, Bayham tp. (Geol. Sur. Can., Vol. V, p. 48Q): Well sunk at a point about 40 feet above Lake Erie. The Corniferous limestone was met with beneath 240 feet of clay.			
Kent County			
Orford tp., east half l. 23, con. XIV (Ont. Bur. Mines, Vol. I, p. 124):			
Surface deposits			
Soil, quicksand and clay	240	240	400 Oil; 1,681 " to 1,700 "
Grey limestone	70	310	
Pink limestone	100	410	
Grey limestone	160	570	
Dark shale	2	572	
Grey to black limestone	628	1,200	
Black shale	3	1,203	
Grey limestone	60	1,263	
White slate or shale	237	1,500	
Grey limestone	10	1,510	
Salt	171	1,681	
Pink limestone	19	1,700	
Grey limestone	240	1,940	
Black shale	48	1,988	
Grey and pink limestone	212	2,200	
Orford tp., l. 20, con. XVI:			
Surface deposits			
Clay and hard pan	110	110	
Gravel and quicksand	102	212	
Soapstone	50	262	
Limestone	103	365	
Porous limestone	10	375	
Clearville, Orford tp. (Ont. Bur. Mines, Vol. XIV, p. 109):			
Surface	167	167	
Hamilton			
Soap (shales)	183	350	
Corniferous			
Limestone	165	515	
Orford tp., l. 10, con. XI (Geol. Sur. Can., Vol. V, Part II, p. 75Q):			
Raney well			
Surface	160	160	
Broken limestone	81	241	
Shale, white	70	311	
Limestone, grey	90	401	
Limestone, pink	154	555	
"Sandstone," fine white	30	585	
"Sandstone," grey	45	630	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Limestone, grey	285	915	
"Sandstone," fine	85	1,000	
A "show" of oil was reported at 470 feet.			
Top of well 740 feet above tide.			
Orford tp., l. 23, con. XIV (Geol. Sur. Can., Vol. V, Part II, p. 76Q):			
Grant well			
Surface	240	240	318 Oil
Broken limestone	10	250	410 "
Limestone, pink and grey	140	390	
Limestone, white	20	410	
"Sandstone," fine grey	30	440	
"Sandstone" and limestone, grey and white	60	500	
Top of well 691 feet above tide.			
Howard tp., con. IV, on the line of Orford tp. (Geol. Sur. Can., Vol. V, Part II, p. 75Q):			
Clay	95	95	
Soapstone and light shales, with a black band near the base	255	350	
Limestone, bluish	150	510	
Limestone, grey, sandy	197	707	
Harwich tp., on the line between Harwich and Howard tps. (Geol. Sur. Can., Vol. V, Part II, p. 74Q):			
Surface	78	78	
Shale, black	60	138	
Shale, white	23	161	
"Soapstone"	10	171	
Limestone, white	15	186	
Shale	70	256	
Limestone, grey	20	276	
Shale, white	100	376	
Soapstone	20	396	
Limestone, white	24	420	
Shale, white	20	440	
Limestone, white	5	445	
Limestone, grey	110	555	
Limestone, blue	15	570	
Blenheim, Harwich tp. (Geol. Sur. Can., Vol. V, Part II, p. 75Q):			
Depth of well 900 feet; gas said to have been met with at 700 and 800 feet.			
Blenheim, Harwich tp. (Ont. Bur. Mines, Vol. I, p. 126):			
Depth of well 1,200 feet. Surface deposits 205. A light flow of gas at 300 feet.			
Harwich tp., l. 9, con. IV (Geol. Sur. Can., Vol. V, Part II, p. 74Q):			
Clay	163	163	
Portage			
Shale	17	180	
Shale, black	58	238	
Hamilton			
"Soapstone"	192	430	
Limestone	70	500	
Top of well 634 feet above tide.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Rondeau, Harwich tp. (Geol. Sur. Can., Vol. V, Part II, p. 74Q):			
Clay	104	104	
Black shale	60	164	
"Soapstone," layers of black shale	200	364	
Limestone	156	520	
Raleigh tp., l. 18, con. XII:			
Surface deposits			
Boulder clay	160	160	
Shale	40	200	
Middle lime	2	202	
Shale	73	275	
Lower lime	185	460	
Raleigh tp., l. 15, con. XII:			
Surface deposits	140	140	
Portage shale	45	185	
Hamilton shale	193	378	
Raleigh tp., l. 19, con. XIV (Ont. Bur. Mines, Vol. XIV, Part I, p. 111):			
Surface			
Boulder clay	184	184	
Hamilton			
Shale	21	205	
Limestone (argillaceous)	6	211	
Shale	29	240	
Limestone	6	246	
Shale	1	247	
Limestone (middle lime)	2	249	
Shale	29½	278½	
Corniferous			
Limestone, very slightly argillaceous	233	511½	
Raleigh tp., l. 15, con. XII:			
South Western Oil and Gas Lands, Ltd. (Bur. Mines, Vol. XVI, Part I, p. 104):			
Surface deposits	110	110	360 Oil
Hamilton			
Soapstone	75	185	
Middle lime	5	190	
Lower soapstone	46	236	
Corniferous			
Lime	124	360	
*Raleigh tp., l. 23, con. VIII:			
Surface deposits	110	110	
Hamilton			
Top rock	5	115	320 Gas
Top soapstone	75	190	362 Oil 367 "
Middle lime	5	195	
Lower soapstone	46	241	
Corniferous			
Lower lime	158	399	
*Raleigh tp., l. 18, con. XIV; John Miller farm:			280 Little Gas
Surface	167	167	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Hamilton			
Soapstone	73	240	308 Oil 344 "
Limestone	6	246	
Soapstone	32	278	
————?			
Limestone	144	422	
Top of well 638 feet above sea level.			
Tilbury East tp., southeast corner, l. 6, con. IX (Jour. Can. Min. Inst., Vol. X, p. 82):			250 Gas 1,250 " 1,362 " 1,370 " 1,376 " 1,382 "
Surface			
Boulder clay	95	95	
Grey sand	5	100	
Clay and gravel	28	128	
Hamilton			1,392 Oil to 1,400 " 1,416 " 1,426 "
Blue clay shale (upper soapstone)	37	165	
Middle lime	10	175	
Blue clay shale (lower soapstone)	67	242	
Corniferous			
Yellow limestone	158	400	
Onondaga			
Grey, drab, brown and blue dolomites, with gypsum and flint (shaly, series with darker shaly dolomites and more gypsum from 835-1185)	1,020	1,420	
Guelph			
Blue-white dolomitic limestone	9	1,429	
A little gas is also often found in this field in the sand or gravel at the bottom of the drift, also in the upper part of the Corniferous in some of the wells, while in other wells some gas and a little oil were found in the upper beds of the Onondaga between 500 and 600 feet. There is also another vein of gas in some of the wells of the Tilbury field at about 1,250 to 1,280 feet in the Onondaga.			
Tilbury East tp., l. 23, con. IX (Ont. Bur. Mines, Vol. XVI, Part II, p. 103):			
Surface	148	148	250 to 270 Oil
Hamilton			
Soapstone	44	192	
Corniferous			
Big lime	78	270	
*Tilbury East tp., l. 2, con. VIII, David Fletcher's home farm:			
Surface deposits	101	101	1,404 Gas
Soapstone	135	236	1,419 Oil 1,435
Limestone	599	835	
Gypsum	5	840	
Limestone	600	1,440	
Fine white limestone	10	1,450	
*Romney tp., l. 22, con. VI. Moses Labontie's farm:			
Surface deposits	142	142	
Soapstone	30	172	
Limestone	144	316	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Romney tp., l. 11, con. II (Ont. Bur. Mines, Vol. XIV, Part I, p. 111):			
Four wells have been sunk here to a depth of 1,298 feet. The water is shut off at a depth of 595 feet in the Niagara. About 400 feet of salt, called by the drillers the "big salt," is also obtained. A very hard grey limestone overlies the oil strata. The oil is found in the Guelph formation.			
Dover tp., l. 19, con. V (Ont. Bur. Mines, Vol. XIV, Part I, p. 110):			
Surface			
Sand	15	15	
Clay	50	65	
Hamilton			
Shale	60	125	
Top rock	40	165	
Soapstone	120	285	
Middle lime	15	300	
Lower soapstone	35	335	
Corniferous			
Lower lime	105	440	
White sand rock	45	485	
Dark sand rock	17	502	
Chatham (Geol. Sur. Can., Vol. V, Part II, p. 73Q):			
Clay	70	70	422 Oil
Soft shaly rocks, black shale	294	364	
"Hard limestone"	58	422	
Limestone?	578	1,000	
Chatham, second well at			
Clay	60	60	475 Oil
Shale, black (Portage)	118	178	
"Soapstone"	200	378	
Limestone	18	396	
"Soapstone"	37	433	
Limestone	567	1,000	
Top of well 583 feet above tide.			
Chatham tp., on the Camden line, con. VII:			
Clay	48	48	
Black shale	100	148	
"Soapstone," etc.	252	400	
Limestone	195	595	
Chatham gore, l. 5, con. I, near Wallaceburg (Geol. Sur. Can., Vol. XI, p. 138S):			
Total depth of well 2,365 feet. Samples of drillings to 2,085 feet were interpreted by H. M. Ami as follows:			
Surface deposits	140	140	
Chemung			
Limestones and shales	545	685	
Hamilton			
Shales and limestones	165	850	
Corniferous			
Limestone, light coloured	150	1,000	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Lower Helderberg, Onondaga and Salina			
Fine-grained dolomites and gypsiferous dolomites.	700	1,700	
Guelph			
Dolomite	120	1,820	
Niagara			
Limestone	105	1,925	
Clinton			
Shales, calcareous and arenaceous	95	2,020	
Medina			
Sandstones, shales	65	2,085	
Camden tp., l. 6, con. IV (Geol. Sur. Can., Vol. V, Part II, p. 72Q):			
Clay	33	33	
Black shale	98	131	
"Soapstone," etc.	229	360	
Limestone	55	415	
Camden tp., l. 2, con. V (Geol. Sur. Can., Vol. V, Part II, p. 72Q):			
Clay	50	50	
Black shale	146	196	
"Soapstone," etc.	202	398	
Limestone	161	559	
Sandstone	10	569	
Camden tp., l. 3, con. II (Geol. Sur. Can., Vol. V, Part II, p. 72Q):			
Surface deposits			
Sand	13	13	
Clay	40	53	
"Hard pan"	7	60	
Shale, black	20	80	
Limestone	30	110	
"Soapstone"	204	314	
Limestone	117	431	
Sandstone	46	477	
Hard rock (limestone)	23	500	
Camden tp., l. 8, con. II (Geol. Sur. Can., Vol. V, Part II, p. 72Q):			
Clay	53	53	
Black shale	200	253	
"Soapstone," etc.	167	420	
Dresden, Camden tp. (Geol. Sur. Can., Vol. V, Part II, p. 73Q):			
Surface	43	43	
Shale, black	180	223	
Limestone	12	235	
Soapstone	172	407	
Limestone	75	482	
Sandstone	44	526	
Limestone, hard	79	605	
Thamesville (Ont. Bur. Mines, Vol. XIV, Part I, p. 110):			
Surface			
Sand	4	4	356 Oil &
Blue clay	50	54	427 Gas
"Stones"	15	69	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Hamilton			
Black shale	10	79	
"Top rock"	40	119	
"Soap"	130	249	
Middle lime	14	263	
Soap	33	296	
Corniferous			
Lower lime	146	442	
Thamesville (Geol. Sur. Can., Vol. V, Part II, p. 72Q):			
Clay	60	60	
Grey shale, etc.	240	300	
Grey limestone	32	332	
Oil met with at a depth of 16 feet in limestone.			
Thamesville (Geol. Sur. Can., Vol. V, Part II, p. 72Q):			
Clay	76	76	
Grey shales, etc.	207	283	
Limestone ("hard")	186	469	
————?	146	615	
Bothwell, (Ont. Bur. Mines, Vol. XIV, Part I, p. 110):			345 Oil
Surface			350 "
Quicksand	15	15	365 "
Clay	45	60	376 "
Running gravel	85	145	
Clay	10	155	
Quicksand	5	160	
Hardpan	7	167	
Hamilton			
"Middle lime"	10	177	
Soapstone	16	193	
Limestone	8	201	
Corniferous			
"Lower lime"	178	381	
Bothwell, (Geol. Sur. Can., Vol. V, Part II, p. 71Q):			
Clinton oil well			
Surface	155	155	
Soapstone	31	186	
Shale, black	4	190	
Soapstone	32	222	
Limestone	148	370	
Top of well 691 feet above tide.			
Bothwell, (Geol.. Sur. Can., Vol. V, Part II, p. 71Q):			
Surface			
Sand	25	25	
Blue clay	45	70	
Boulder clay	20	90	
————?			
Shale, black	77	167	
Soapstone, etc.	193	360	
Limestone	120	480	
Bothwell, (Geol. Sur. Can., Vol. V, Part II, p. 71Q):			
Clay	90	90	
Shale, e'c.	270	360	
Limestone	120	480	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Kent County—Continued			
Empire well			
Clay	120	120	420 Oil
Shale	160	280	
Limestone	140	420	
Pepper well			
Clay	120	120	210 Oil
Oil was found at 210 feet.			
Chambers well gave oil at 385 feet.			
Thames well sunk to 618 feet; oil was met with at 475 feet.			
Zone tp., l. 7, con. VIII (Ont. Bur. Mines, Vol. VI, p. 19):			
Surface deposits			
Sand	20	20	373 Small 378 flow Oil
Blue clay	30	50	
Gravel, sand, clay	30	80	
Gravel	100	180	
Hamilton			
Shale	33	213	
Corniferous			
Limestone	187	400	
Samples of the drillings from this well from the base of the shale have been examined by Dr. Coleman, who reports on them as follows:			
213-219 feet, bluish grey calcareous shale.			
219-225 feet, bluish grey limestone, somewhat bituminous.			
225-263 feet, pale grey to white limestone, with parts of brachiopods at 242-247.			
263-268 feet, bluish grey to white limestone.			
268-278 feet, pale brownish grey to white limestone.			
300-330 feet, greyish white limestone.			
330-350 feet, greyish white limestone, with bluish grey fragments of shale, which may be accidental; brachiopods at 340-345.			
350-360 feet, brownish white limestone.			
368-373 feet, yellowish limestone.			
373-383 feet, brownish yellow limestone.			
383-388 feet, brown dolomite.			
393-398 feet, brownish sandstone with calcareous cement.			
398-399 feet, brown sandstone, well rounded grains.			
Essex County			
Leamington (Ont. Bur. Mines, Vol. XIV, Part I, p. 115):			
Surface			
Sand	10	10	
Clay	80	90	
Gravel	10	100	
Limestone was struck at 100 feet which continued, together with gypsum and dolomite formations, to the finish of the well at 1,091 feet. Some gas at 765 and 960 feet. Sprayed oil at 1,080 feet. At 1,080 feet well probably made 1,000,000 cubic			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
feet per day. Oil comes from Guelph formation at a depth of about 1,040 feet in the southern end of the field, and about 1,125 feet in the northern part.			
Mersea tp., east lot 239, North Talbot road (Ont. Bur. Mines, Vol. XV, Part I, p. 112; *see also* Vol. XIV Part I, p. 116):			
Surface	89	89	
Onondaga			
Limestone and dolomites with gypsum	1,006	1,095	
Guelph, Niagara and Clinton			
Limestones and dolomites	375	1,470	
Medina			
Red shales	410	1,880	
Hudson River and Utica			
Blue and black shales	608	2 488	
Trenton			
Limestones, grey and dark	408	2,896	
Mersea tp., l. 7, con. I, one mile south of Leamington (Geol. Sur. Can., Vol. V, Part II, p. 84Q):			
Clay	100	100	
Limestone	310	410	
Mersea tp., south half l. 5, con. II, west of Leamington (Geol. Sur. Can., Vol. V, Part II, p. 84Q):			
Depth of well 1,030 feet; surface deposits 128 feet thick; gas in small quantity at 965 feet.	....	....	965 Gas
Mersea tp., N.W. corner, l. 7, con. IX (Geol. Sur. Can., Vol. V, Part II, p. 85Q):			
Depth of well about 1,200 feet. Small flow gas at 1,050 feet.			
Mersea tp., l. 9, con. IX (Ont. Bur. Mines, Vol. XIV, Part I, p. 116):			
Depth of well 1,125 feet.			
Gosfield tp., S.W. corner of S. half l. 1, con. I (Geol. Sur. Can., Vol. V, Part II, p. 82Q):			
Depth of well 1,038 feet.			
Gosfield tp., l. 8, con. II (Geol. Sur. Can., Vol. V, Part II, p. 82Q):			
Depth of well 1,017 feet.			
Gosfield tp., l. 5, con. II (Geol. Sur. Can., Vol. V, Part II, p. 83Q):			
Depth of well was 1,095 feet; small quantities of gas at 1,090 feet. Surface deposits 117 feet.	....	....	1,090 Gas
Gosfield South tp., east division, l. 3, con. I (Geol. Sur. Can., Vol. V, Part II, p. 83Q):			
Depth of well 1,126 feet; gas was met with at 750 feet.	....	....	750 Gas
Gosfield tp., on road allowance of second concession, 55 yds. west of well on N.W. corner l. 7, con. I of Gosfield tp. (Geol. Sur. Can., Vol. V, Part II, p. 83Q):			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Depth of well 1,020 feet. Daily flow of 7,014,000 cubic feet of gas obtained in the vesicular dolomite at 1,020 feet.	....	....	1,020 Gas
Gosfield South tp., l. 4, con. I (Geol. Sur. Can., Vol. V, Part II, p. 84Q): Depth 1,085 feet. Small flow gas at 980 feet.	....	....	980 Gas
Gosfield South tp., l. 18, con. III (Geol. Sur. Can., Vol. V, Part II, p. 84Q): Depth of well 1,184 feet; small "show" of gas was noted at 1,020 feet.	....	....	1,020 Gas
Gosfield tp., l. 8, con. II (Jour. Can. Min. Inst., Vol. III, p. 70):			
Surface			
Mostly sand	141	141	
Onondaga			
Grey, drab, brown and blue dolomites with gypsum (shaly group from 585 ft. to 930 ft.), (gypsum bed from 1,055 to 1,070 ft.)	960	1,101	
Gosfield tp., N.W. corner of l. 7, con. I (Geol. Sur. Can., Vol. V, Part II, p. 82Q): Gas struck at 1,017 feet in a vesicular dolomite, probably of Clinton age; volume of gas 10,000,000 cubic feet a day. Depth of well 1,021 feet.			
Gosfield tp., N.W. corner of l. 7, con. I (Jour. Can. Min. Inst., Vol. III, p. 70):			
Surface			
Soil	5	5	910 Little 930 Gas
Drift, grey sand	115	120	1,020 Large quantity Gas
Onondaga			
Brown and grey dolomitic limestones with gypsum and with white and black flint	380	500	
Grey, blue and shaly dolomites and drab brown dolomites with a good deal of gypsum	360	860	
Dark brown dolomites and gypsum (with gypsum bed from 970 to 985 feet)	160	1,020	
Guelph			
Grey-blue crystalline vesicular dolomite	11	1,031	
Flow of gas from this well measured 10,000,000 cu. ft. per day.			
Colchester South tp., l. 64, con. I (Jour. Can. Min. Inst., Vol. III, p. 73; *see also* Geol. Sur. Can., Vol. XI, p. 138S):			
Surface			
Sand	20	20	2,150 Little Gas and Oil
Quicksand	90	110	
Onondaga			
Grey and brown dolomitic limestone with flint and gypsum	67	177	
White fine sharp sand	10	187	
White, grey and brown dolomites with white and black flint and with gypsum	203	390	
Grey, blue and brown dolomites (mostly shaly with a good deal of gypsum), shaly group	370	760	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Dark grey and brown dolomite with gypsum (gypsum bed 865-875 feet)	150	910	
Guelph and Niagara			
Blue, white, grey, and brown dolomite, quite crystalline and very porous	215	1,125	
Clinton			
White and blue limestones	155	1,280	
Medina			
Grey blue shale	7	1,287	
Grey blue limestone	5	1,292	
Green shales	8	1,300	
Red pink shales	5	1,305	
Grey blue unctuous shales	88	1,393	
Grey blue and white sandy limestone	62	1,455	
Red pink shales	110	1,565	
Hudson River			
Grey blue lime shales with shells of lime	350	1,915	
Utica			
Brown and black shales	235	2,150	
Trenton			
White and dark grey limestones	270	2,420	
Colchester tp., l. 11, con. VI, "Walkers No. 2" (Geol. Sur. Can., Vol. V, Part II, p. 81Q):			
Depth of well 1,016 feet; the record to this depth is very similar to "Walkers No. 1" below. Oil and gas at 1,000 feet; this well is said to have pumped five barrels of oil per day.			
Colchester tp., l. 16, con. VI (Geol. Sur. Can., Vol. V, Part II, p. 81Q):			
Surface	93	93	
Corniferous			
Limestone, white and grey	92	185	
Onondaga			
Dolomites and gypsum with blue-black shales towards bottom	740	925	
Guelph and Niagara			
Dolomites	217	1,152	
Clinton			
Limestone	2	1,154	
Colchester tp., l. 283, South Talbot Road, Essex Centre (Geol. Sur. Can., Vol. V, Part II, p. 82Q):			
Depth of well 1,200 feet; another well at Essex Centre reached a depth of 209 feet, of which 130 feet were surface deposits.			
Colchester North tp., l. 19, con. IX (Geol. Sur. Can., Vol. V, Part II, p. 82Q):			
Depth of well 1,135 feet.			
Colchester North tp., N.W. corner l. 17, con. VII (Jour. Can. Min. Inst., Vol. III, p. 71):			
Surface			
Mostly clay	65	65	
Corniferous and Onondaga			
White-grey limestones and brown dolomitic limestones with gypsum below 260 feet	610	675	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Onondaga			
Grey-blue dolomitic shales and shaly dolomites and drab brown dolomites with a good deal of gypsum; gypsum bed 680-690 feet	300	975	
Dark grey and brown dolomites with gypsum; gypsum bed from 1,125 to 1,140 feet	200	1,175	
Colchester tp., l. 8, con. VI, "Walker's No. 1" (Geol. Sur. Can., Vol. V, Part II, p. 80Q):			
Surface			
Clay	35	35	100 Gas
Sand	52	87	Oil
Limestone, grey	113	200	
" white	70	270	
" grey	70	340	
" grey and white	10	350	
" brown	10	360	
" brown and grey	5	365	
" fine grey	5	370	
" dark brown	270	640	
" brown and white	20	660	
" " "	10	670	
Shale, dark grey and limestone	10	680	
Limestone, light pink	40	720	
" dark pink	35	755	
" grey	75	830	
Shale, dark grey and limestone	100	930	
Limestone, grey and white	10	940	
" brown and white	130	1,070	
" fine white	10	1,080	
" and sandstone, brown	200	1,280	
Malden tp., l. 2, con. I, "The Colwell Grove Well" (Geol. Sur. Can., Vol. V, Part II, p. 79Q):			
Surface	8	8	
Limestone	252	260	
Sandstone (?)	60	320	
Limestone	180	500	
Shale and gypsum	16	516	
Limestone, hard	320	836	
Limestone, soft	297	1,133	
Limestone	265	1,398	
Grey shale	20	1,418	
Malden tp., l. 4, con. II, "The Parks Well" (Geol. Sur. Can., Vol. V, Part II, p. 81Q):			
Sand and gravel	30	30	987 Gas
Limestone	228	258	
Sandstone (?)	84	342	
Limestone	182	524	
Gypsum	12	536	
Limestone	468	1,004	
Small quantities of gas at 987 feet.			
"The Fraser Well," one-half mile east of the Detroit river, Anderdon tp., near town line (Geol. Sur. Can., Vol. V, Part II, p. 79Q):			
Depth of well 530 feet, seventy feet of which consists of surface deposits.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Windsor, Sandwich E. tp. (Ont. Bur. Mines, Vol. XX, Part I, p. 254):			
Drift			
Limestone	570	570	
Sandstone	130	700	
Limestone	356	1,056	
Salt	90	1,146	
Limestone	30	1,176	
Salt	30	1,206	
Limestone	100	1,306	
Salt	35	1,341	
Shale	100	1,441	
Salt	200	1,641	
Windsor (Geol. Sur. Can., Vol. XV, p. 225S):			
Surface deposits	133	133	
Limestone	922	1,055	
Salt	30	1,085	
Limestone	25	1,110	
Break in record	35	1,145	
Salt	75	1,220	
Limestone	100	1,320	
Salt	70	1,390	
Limestone	30	1,420	
Salt	252	1,672	
Well ended in limestone.			
Windsor (Geol. Sur. Can., Vol. XV, p. 225S):			
Surface deposits	132	132	
Dolomite	118	250	
Limestone (petroliferous)	25	275	
Dolomite (marly)	85	360	
Limestone (dark petroliferous)	30	390	
Dolomite (crystalline)	20	410	
Limestone, drab colour	75	485	
Sandstone, pure quartzose	55	540	
Dolomite with gypsum	50	590	
" shaly	30	620	
" grey and fawn	170	790	
" with scales of carbonaceous matter	40	830	
" grey	190	1,020	
" shaly, argillaceous	57	1,077	
Rock salt	40	1,177	
*Sandwich, Sandwich W. tp.:			
Surface deposits	82	82	
Lime rock	443	525	
Sandstone	100	625	
Lime rock	425	1,050	
Salt	40	1,090	
Lime rock	200	1,290	
Salt, thick bed			
Depth of well	....	1,565	
Maidstone tp., l. 12, con. VI (Geol. Sur. Can., Vol. V, Part II, p. 78Q):			
Blue clay	92	92	
Surface, hardpan	3	95	
Limestone, blue	90	185	
Shale, dark	90	275	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Sandstone, white	25	300	
Limestone	925	1,225	
Sandstone (?), grey	25	1,250	
————?	215	1,465	
Another well drilled close to the foregoing reached a depth of 1,010 feet. The records of the rocks pierced were practically the same.			
Rochester tp., l. 28, con. II (Ont. Bur. Mines, Vol. XV, Part 1, p. 111):			
Surface deposits			
Boulder clay	144	144	
Corniferous			
Limestone	84	228	
Oriskany			
Sandstone	40	268	
Onondaga			
Dolomite and limestone with gypsum	1,037	1,305	
Guelph			
Blue-white crystalline dolomite	25	1,330	
Tilbury West tp., l. 7, con. III (Ont. Bur. Mines, Vol. XIV, Part I, p. 117):			
Surface	120	120	1,200 Oil
Corniferous			
Limestone	163	283	
Oriskany			
Sandstone	20	303	
Onondaga			
Limestone and shale	897	1,200	
Guelph			
Crystalline dolomite	183	1,383	
Tilbury West tp., l. 7, con. V (Geol. Sur. Can., Vol. V, Part II, p. 77Q):			
Surface	120	120	1,213 Oil
Corniferous			
"Hard rock" (limestone?)	53	173	
Limestone, white	110	283	
Oriskany			
Sandstone	20	303	
Onondaga			
Limestone	200	503	
Sandstone	10	513	
Limestone, soft	76	589	
Limestone, hard	23	612	
Sandstone	35	647	
Limestone, soft	27	674	
Limestone, hard	12	686	
Limestone, soft	34	720	
Limestone, hard	22	742	
Shale	100	842	
Limestone, soft	12	854	
Limestone, hard	125	979	
Limestone, white, with shale	50	1,029	
Limestone, blue	10	1,039	
Limestone, hard, with shale	55	1,094	
"Very hard rock," with pyrites	20	1,114	
Limestone, hard	156	1,270	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Guelph			
Limestone	10	1,280	
Top of well 604 feet above tide.			
Tilbury West tp., l. 7, con. III (Jour. Can. Min. Inst., Vol. III, p. 72):			
Surface			
Boulder clay	120	120	
Corniferous			
White and yellow brown limestones	130	250	
Oriskany			
White yellowish fine sandstone	50	300	
Onondaga			
Yellow, white, and brown dolomites (with gypsum from 450 to 550 ft.; with flint from 550 to 650 ft.; darker brown with gypsum from 650 to 800 ft.)	500	800	
Shaly group. Blue and brown (mostly quite shaly) dolomites with a good deal of gypsum.	330	1,130	
Dark grey and brown dolomites with gypsum (gypsum bed from 1,275 to 1,295 feet)	185	1,315	
Guelph			
White-grey crystalline limestone	18	1,333	
Comber, one-half mile west and one mile south (Geol. Sur. Can., Vol. V, Part II, p. 78Q):			
Clay	124	124	260 Gas
Limestone	136	260	1,078 "
Limestone, white	100	360	
Sandstone	10	370	
Limestone, in alternate soft and hard layers	370	740	
Shale, with streaks of hard "lime"	100	840	
Limestone	135	975	
Limestone, white, with shale	50	1,025	
Limestone with shale	53	1,078	
Limestone, hard	128	1,206	
Limestone, very hard	100	1,306	
Top of well 600 feet above tide.			
Pelee island (Ont. Bur. Mines, Vol. XIV, Part I, p. 117):			
Surface	58	58	750 Oil
Corniferous and Oriskany			
For the most part impure fossiliferous limestone with corals, shells and carbonaceous matter	222	280	
Oriskany?			
Sandstone?	44	324	
Lower Helderberg and Onondaga			
Consisting of gypsum and gypsiferous dolomites, light yellow, dark grey and bluish grey in colour	458	782	
Pelee island, John Finlay farm (Ont. Bur. Mines, Vol. VI, p. 18):			
The log of this well is not satisfactorily recorded, but is given for what it is worth.			
Impure limestone or dolomite 93-204			
Dolomitic limestone 450-500			
Dolomite, gypsiferous 660			
Magnesian limestone 710			
Magnesian limestone and gypsum 730			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Essex County—Continued			
Dolomite and some gypsum 740			
Magnesian limestone or dolomite 749			
Dolomite 755			
Magnesian limestone 759			
Magnesian limestone 761			
Grey dolomite 764			
Lambton County			
Euphemia tp. (Geol. Sur. Can., Vol. V, Part II, p. 66Q):			
Surface	53	53	367 Oil
Hamilton			
Shales, etc.	224	277	
Corniferous			
Limestone	93	370	
Another well here gave			
Surface	58	58	
Hamilton			
Shales, etc.	265	323	
Corniferous			
Limestone	37	360	
Euphemia tp. (Fairbanks & Carman) (Ont. Bur. Mines, Vol. XIV, Part I, p. 114):			
Surface			
Clay	48	48	366 Oil
Hamilton			
"Top rock"	50	98	
Soapstone	130	228	
Middle lime	20	248	
Soapstone	18	266	
Corniferous			
Lower lime	120	386	
Dawn tp. (Ont. Bur. Mines, Vol. XIV, Part I, p. 114):			
Surface			
Clay	38	38	250 Oil
Hamilton			
"Streaked with lime"	20	58	
Soapstone	128	186	
Middle lime	20	206	
Soapstone	25	231	
Lime	4	235	
Soapstone	2	237	
Corniferous			
Lower lime	100	337	
Dawn tp., l. 32, con. X (Geol. Sur. Can., Vol. V, Part II, p. 66Q):			
Surface	50	50	
Shale, black	70	120	
Limestone	70	190	
Shale and limestone	285	475	
Limestone	225	700	
Sombra tp., l. 12, con. VII (Geol. Sur. Can., Vol. V, Part II, p. 67Q):			
Clay 112 feet; black shale 100 feet.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Sombra tp., l. 12, con. X (Geol. Sur. Can., Vol. V, Part II, p. 67Q):			
Clay 120 feet; black shales 20 feet; "soapstone," 60 feet.			
Corunna, Moore tp., l. 28, con. I (Geol. Sur. Can., Vol. V, Part II, p. 67Q):			
Surface deposits			
Clay	54	54	
Shingle of black shale	56	110	
Clay	10	120	
Portage and Chemung			
Shale, black	8	128	
Sandstone, greenish	20	148	
Shale, black, with pyrites	185	333	
Hamilton			
Grey shale and lime	17	350	
Courtright (Geol. Sur. Can., Vol. V, Part II, p. 68Q):			
Surface deposits			
Sand	132	132	
Hardpan	28	160	
Portage			
Shale, black	32	192	
Hamilton			
Limestone	40	232	
Shale and limestone	310	542	
Limestone, white	50	592	
Corniferous			
Limestone, grey	100	692	
Onondaga, including lower part of Corniferous			
Limestone, white hard	370	1,062	
Sandstone or dolomite?	32	1,094	
Limestone	400	1,494	
Limestone and gypsum	126	1,620	
Salt	32	1,652	
Gypsum	13	1,665	
Top of well 588 feet above tide.			
Some gas was met with at the base of the surface deposits.			
Moore tp., l. 3, con. X (Ont. Bur. Mines, Vol. XIV, Part I, p. 112):			
Surface	148	148	445 to 450 Oil 400 Gas
Hamilton			
"Top rock" (upper lime)	45	193	
Shale (upper soapstone)	125	318	
Limestone (middle lime)	15	333	
Shale (lower soapstone)	47	380	
Limestone (lower lime)	111	491	
Moore tp. (drilled by Fairbanks and Carman) (Ont. Bur. Mines, Vol. XIV, Part I, p. 112):			
Surface	143	143	395 Oil 410 "
Hamilton			
"Top rock"	48	191	
Soapstone	130	321	
Middle lime	15	336	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Soapstone	42	378	
Streak of lime	3	381	
Soapstone	2	383	
Corniferous			
Lower lime	68	451	
Details of the Corniferous formation in this well are as follows:			
Crystalline limestone		395	
Grey		400	
Grey		402½	
Grey, no oil		405	
Soft		407½	
Rock well browned with oil		410	
Grey		412	
Crystalline		417½	
Soft, browner, more crystalline		422½	
Grey, oil came in		425	
Hard		427½	
Brown and more sandy		430	
Crystalline		437½	
*Moore tp., West half l. 2, Con. X. Furnished by John D. Noble, Petrolia:			
Surface	149	149	
Top rock	55	204	
Top soapstone	120	324	
Middle lime	15	339	
Lower soapstone	45	384	
Total depth of well		495	
Depth of lower lime, 384 feet.			
*Moore tp., East half l. 1, con. IX. Furnished by John D. Noble, Petrolia:			
Surface	130	130	
Top rock	65	195	
Top soapstone	125	320	
Middle lime	15	335	
Lower soapstone	45	380	
Total depth of well		490	
Depth of lower lime, 380 feet.			
*Moore tp., East half l. 4, con. VIII. Furnished by John D. Noble, Petrolia:			
Surface	147	147	425 Gas
Top rock	65	212	455 Oil
Top soapstone	120	332	
Middle lime	15	347	
Lower soapstone	45	392	
Total depth of well		491	
Depth of lower lime, 392 feet.			
*Moore tp., North part l. 3, con. VIII. Furnished by John D. Noble, Petrolia:			
Surface	144	144	
Top rock	60	204	
Top soapstone	120	324	
Middle lime	14	338	
Lower soapstone	50	388	
Total depth of well		500	
Depth of lower lime, 388 feet.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Petrolia (Geol. Sur. Can., Vol. V, Part II, p. 62Q):			
Surface	104	104	450 Oil 480 "
Hamilton			
Limestone	40	144	
Shale	130	274	
Limestone	15	289	
Shale	43	332	
Limestone	68	400	
Corniferous			
Limestone, soft	40	440	
Limestone, grey	25	465	
Limestone, grey	135	600	
Onondaga, including the Oriskany if present			
Limestone, hard, white, with hard streaks of sandstone from 2 to 5 feet thick	500	1,100	
Gypsum	80	1,180	
Salt and shale	105	1,285	
Gypsum	80	1,365	
Salt and shale	140	1,505	
Top of well 667 feet above tide.			
The oil horizon lies at a depth of from 450 to 480 feet; it occurs in the Corniferous limestone.			
This record may be taken as typical of the wells sunk in the Petrolia field.			
Oil Springs (Geol. Sur. Can., Vol. V, Part II, p. 62Q):			
(East side of field)			
Surface	60	60	370 Oil
Hamilton			
Limestone (upper lime)	35	95	
Shale (upper "soapstone")	101	196	
Limestone (middle lime)	27	223	
Shale (lower "soapstone")	17	240	
Corniferous			
Limestone (lower lime)	130	370	
(West side of field)			
Surface	80	80	370 Oil
Shale (upper "soapstone")	116	196	
Limestone (middle lime)	27	223	
Shale (lower soapstone)	17	240	
Corniferous			
Limestone (lower lime)	130	370	
Oil is found in both these wells at 370 feet, or about 60 feet below the summit of the Corniferous limestone.			
Oil Springs, other wells at (Geol. Sur. Can., Vol. V, Part II, p. 63Q):			
Enniskillen tp., l. 19, con. 11.			
Clay 42 feet; shale, etc., 182 feet, at which depth a copious flow of oil was obtained; 595 feet limestone.			
Enniskillen tp., l. 18, con. II.			
Depth of well 1,000 feet; clay 77 feet, grey shale, etc., 300 feet, below which only "hard rock" was found, until near the bottom, when soft shales were again met with, in this well small portions of oil were said to have been found by the sand pumps at depths of 210 and 400 feet in the solid rock beneath the shales.			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Enniskillen tp., l. 18, con. II, Fairbanks well (Ont. Bur. Mines, Vol. XXIII, Part I, p. 36):			
Surface	75	75	1,898 to 1,912 Gas
Top soapstone	106	181	
Lime	17	198	
Lower soapstone	34	232	
Limestone and dolomite	998	1,230	
Salt	35	1,265	
Dolomite	57	1,322	
Salt and hard streak	238	1,560	
Brown dolomite	166	1,726	
Salt	40	1,766	
Dolomite	127	1,893	
Dolomite (light)	5	1,898	
Dolomite gas rock	14	1,912	
Oil Springs (Ont. Bur. Mines, Vol. XIV, Part I, p. 113):			
Surface			
Blue clay	58	58	
Hamilton			
"Top rock"	55	113	
Soapstone	109	222	
Middle lime	15	237	
Soapstone	30	267	
Corniferous			
Lower lime	131	398	
Enniskillen tp., l. 11, con. XI (Ont. Bur. Mines, Vol. XIV Part I, p. 113; *see also* Guide Book No. 4, Int Geol. Cong., 1913, p. 100; *see also* Ont. Bur. Mines, Vol. XV, Part I, p. 111):			
Surface			
Blue clay	90	90	
Hamilton			
Shale and limestone	240	330	
Onondaga			
Limestones (oil horizons)	190	520	
Monroe?			
Banded grey, brown and black dolomites	690	1,210	
Salina			
Salt	65	1,275	
Dolomite	20	1,295	
Salt and dolomite	140	1,435	
Dolomite	30	1,465	
Salt	90	1,555	
Salt and dolomite	50	1,605	
Salt	25	1,630	
Grey dolomite	10	1,640	
Salt	67	1,707	
Dolomite and salt	40	1,747	
Salt	138	1,885	
Dolomite, limestone, grey shales	130	2,015	
Salt	90	2,105	
Guelph and Niagara			
Dolomites	275	2,380	
Cataract?			
Red and dark shales	60	2,440	
Limestones	90	2,530	
Richmond (Queenston)			
Red shales	275	2,805	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Richmond and Lorraine			
Grey shales and limestone	205	3,010	
Collingwood and Utica			
Dark shales	165	3,175	
Trenton and Black River			
Limestones, etc.	170	3,345	
Lowville (?)			
Limestones	115	3,460	
Chazy			
Shale and limestone	317	3,777	
N. L. Bowen gives the depth of this well as 3,947 feet. *See* Ont. Bur. Mines, Vol. XX, Part I, p. 254.			
Top of well 667 feet above sea level.			
Brooke tp., l. 5, con. IV (Ont. Bur. Mines, Vol. XV, Part I, p. 111):			
Surface deposits			
Clay	60	60	
Gravel	5	65	
Hamilton			
Shales	85	150	
Upper lime	15	165	
Upper soapstone	205	370	
Middle lime, dark brown	25	395	
Lower soapstone	25	420	
Corniferous			
Limestone	115	535	
Onondaga			
Dolomites, limestones and marls with gypsum and salt	1,300	1,835	
Guelph and Niagara			
Limestones and dolomites	225	2,060	
Niagara			
Dark shales	15	2,075	
Clinton			
Limestone	35	2,110	
Medina			
Red shales	440	2,550	
Hudson River			
Light grey shales with limestone shells	275	2,825	
Utica			
Dark shales	175	3,000	
Trenton			
Limestone	280	3,380	
In the Onondaga, rock salt from 1,410 to 1,655 feet or 245 feet of it in a solid bed, with only 3 small layers of limestone. Rock salt 1,810-1,835 feet.			
Top of well 690 feet above sea level.			
Sarnia (Ont. Bur. Mines, Vol. XX, Part I, p. 254):			
Drift	122	122	
Black shale	40	162	
Limestone	80	242	
Shales	185	427	
Limestone	30	457	
Shales	46	503	
Limestone	987	1,490	
Gypsum	5	1,495	
Shales and salt	15	1,510	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Salt	56	1,766	
Shales	18	1,784	
Salt	30	1,614	
Sarnia (Geol. Sur. Can., Vol. V, Part II, p. 69Q):			
Peterson's well			
Surface	200	200	330 Gas 515 "
Portage			
Shale, black	15	215	
Hamilton, including upper part of Corniferous			
Limestone	150	365	
Shale	85	450	
Limestone	5	455	
Shale	60	515	
Limestone	170	685	
Small flows gas at 330 and 515 feet.			
Agricultural works			
Surface	130	130	515 Gas
Shale, black (Portage)	80	210	
Limestone	80	290	
Shale	160	450	
Limestone	5	455	
Shale	60	515	
Limestone	150	665	
Dicken's well, near corner Rose and Tecumseh streets.			
Surface deposits			
Surface	130	130	473 Gas
Hardpan	55	185	
Gravel	15	200	
Hamilton			
Limestone	90	290	
Shale	100	390	
Limestone	5	395	
Shale	68	463	
Limestone	77	540	
Gas at 473 feet; 20,000 cubic feet per day.			
Sarnia tp., l. 15, block A, Indian Reserve (Geol. Sur. Can., Vol. V, Part II, p. 68Q):			
Surface	124	124	480 Oil and Gas
Portage			
Shale, with hard "streaks"	32	156	
Hamilton			
Shale and limestone	324	480	
Limestone	15	495	
At 480 feet 20,000 cubic feet gas per day; gas accompanied by some oil.			
Sarnia (Geol. Sur. Can., Vol. V, Part II, p. 69Q):			
King's grist mill			
Surface deposits			
Surface sands	9	9	460 Gas
Blue clay	109	118	
"Hardpan"	2	120	
Portage			
Shale, black	36	156	
Hamilton			
Limestone	30	186	
Shale	263	449	

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
Limestone	5	454	
Shale	40	494	
Limestone	60	554	
Corniferous			
Limestone	100	654	
Onondaga, including lower part of Corniferous			
Limestone, hard	546	1,200	
Limestone, hard and flinty	200	1,400	
Limestone with gypsum	105	1,505	
Top of well 589 feet above tide.			
Small quantities of gas at 400 feet.			
*Sarnia tp., South half l. 3, con. VII:			
Surface deposits	100	100	437 Oil
Hamilton			
First lime	25	125	
First soapstone	150	275	
Second lime	5	280	
Second soapstone	50	330	
Lower lime	156	486	
*Sarnia tp., l. 7, con. VII:			
Surface deposits	124	124	475 Oil
Hamilton			
Top rock	51	175	
Top soapstone	122	297	
Middle lime	5	302	
Lower soapstone	60	362	
Lower lime	123	485	
*Sarnia tp., West half l. 2, con. VI:			
Surface deposits	104	104	430 Oil
Hamilton			
First lime	43	147	
First soapstone	129	276	
Middle limestone	7	283	
Soapstone	58	341	
Lower lime	136	477	
Wyoming, in Plympton tp., l. 15, con. I (Geol. Sur. Can., Vol. V, Part II, p. 64Q):			
Surface	104	104	
Portage			
Black shale	4	108	
Hamilton			
Limestone	40	148	
Shale	130	278	
Limestone	15	293	
Shale	43	336	
Limestone	68	404	
Corniferous			
Limestone, soft	40	444	
Limestone, grey	36	480	
Top of well 697 feet above tide.			
Kingston Mills, Warwick tp. (Geol. Sur. Can., Vol. V, Part II, p. 64Q):			
Depth of well 1,400 feet; well terminated in a "hard rock"; salt was said to be found at 1,200 feet,			

Well Records in Ontario—Continued

Localities and formations	Thickness Feet	Depth Feet	Depth at which oil or gas occurred
Lambton County—Continued			
continuing, interstratified with shale for 130 feet or to a total depth of 1,330 feet, beneath which there was a "hard rock" 70 feet thick. The log of another well here is as follows:			
Clay	14	14	
Portage			
Black shale	50	64	
Hamilton			
Shales, soft and limestone	396	460	
Corniferous			
Limestone, hard	44	504	
Port Franks, Bosanquet tp. (Geol. Sur. Can., Vol. V, Part II, p. 65Q):			
Surface deposits			
Fine sand	60	60	
Gravel	16	76	
Clay and gravel	178	254	
Gravel	6	260	
Limestone	940	1,200	
Shale	45	1,245	
Salt and shale	110	1,355	
The limestone will probably include the lower part of the Hamilton, the whole of the Corniferous and that part of the Onondaga overlying the salt beds. At 365 feet from the surface the driller reported 4 or 5 feet of soft marl-like beds.			
Top of well is 590 feet above tide.			
Widder station, Bosanquet tp. (Geol. Sur. Can., Vol. V, Part II, p. 65Q):			
Clay 34 feet; soft shale, etc., 196 feet; limestone 120 feet; oil at 196 feet.			
Bosanquet tp., l. 3, on southern line of the township, near Arkona (Geol. Sur. Can., Vol. V, Part II, p. 65Q):			
This well showed above the boring the strata of the Hamilton shales nearly as follows in descending order: hard limestone 8; shale 40; limestone 3; shale 9; from which point a boring was carried 224 feet; hard white limestone, yielding some oil, 18 feet, equals 242 feet. This shows 284 feet of the Hamilton formation at this point.			
Bosanquet tp., l. 12, con. X (Geol. Sur. Can., Vol. V, Part V, p. 65Q):			
Clay 90; hard black shale 95; soft shales 350 feet. Boring at bottom was in soft grey calcareous marl resembling the Hamilton.			

INDEX VOL. XXIV, PART II

TWENTY-FOURTH ANNUAL REPORT

OF THE

ONTARIO BUREAU OF MINES, 1915,

BEING

VOL. XXIV., PART III.

The Porcupine Gold Area

(THIRD REPORT)

By A. G. BURROWS

APPENDIX I.—THE KAMISKOTIA LAKE AREA

APPENDIX II.—WATER POWERS IN THE PORCUPINE AREA

ERRATUM.

Page 47, third line from top, " average extraction was 92.26 per cent." should read " average extraction was 97.26 per cent."

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APPENDIX II

ILLUSTRATIONS.

Frontispiece. Looking east over Pearl Lake, McIntyre mine in foreground.
Looking northwest over the Hollinger property.

PREFACE

Acknowledgments

The writer had the valued assistance of Mr. P. E. Hopkins of the geological Department, both in the field work and in the preparation of this report and accompanying maps. He is also indebted to Dr. W. G. Miller, Provincial Geologist, for suggestions as to the geological mapping of the area.

The photomicrographs illustrating the report were kindly prepared by my colleague, Mr. C. W. Knight, and the chemical analyses were made by Mr. W. K. McNeill. The production of the maps and inserts in the report was in charge of Mr. W. R. Rogers, topographer to the Department.

Every facility was extended by the managers of the various properties in the Porcupine area for examination of mine plans and underground workings.

Maps

A geological map, No. 24d, on a scale of 2,000 feet to the inch accompanies the report. It includes the greater portions of Tisdale and Whitney townships, and the north parts of Deloro and Shaw. This represents only a small portion of the area which had been examined previously in a more general way and shown on the geological map, No. 21a, of the Porcupine gold area, 1912.

Another map, No. 24e, on a scale of 1,000 feet to the inch, showing in greater detail the Hollinger-Dome area, is included.

References are made in this report to localities which are shown on the general map, No. 21a, but not on the detailed maps of 1,000 and 2,000 feet to the inch.

Photo by A. Tomkinson.

Looking east over Pearl lake, McIntyre mine in foreground and town of Schumacher at the Narrows

Looking northwest over the Hollinger property. The town of Timmins, and high hill $1\frac{1}{2}$ miles away on north boundary of the township of Godfrey may be seen in the background on the left

THE PORCUPINE GOLD AREA

(Third Report)

By A. G. Burrows

Situation

The Porcupine gold area, which for the past six years has held the attention of the mining public, is situated on the Hudson Bay slope of northern Ontario. The latitude of Niven's First Base Line of 1899, which forms the south boundary of Tisdale and Whitney townships, is 48° 27′ 54″; consequently the area is somewhat farther south than the Canada-United States boundary in Manitoba and other western provinces. The camp is in the Timiskaming judicial district. Lying along the southern fringe of the great clay belt of northern Ontario, it adjoins a prospective farming country. In this belt many townships have been laid out in six or nine-mile squares and subdivided into concessions and lots; in the gold area itself and in the adjoining country to the north, many half lots containing 160 acres each have been granted to veterans as homesteads.

A portion of the town of Timmins, with Gillies lake in the background, July 1914

Since the second report on this area was written there has been practically no extension of the gold-bearing area. At various times there has been considerable activity in some of the outlying regions, but up to the present no finds have been made that compare with those of Tisdale township. Outlying areas which have attracted attention in the past two years are those situated in McArthur, Turnbull and Robb townships.

It is remarkable that the earliest discoveries at Porcupine have been developed into the largest producers. The outstanding mine is the Hollinger, named after its discoverer, Benjamin Hollinger. The discoveries on Pearl lake by Alexander McIntyre developed into the McIntyre mine, and that of John Wilson in the southeast part of Tisdale into the Dome mine. The large producing mines are all confined to Tisdale township, and the majority of these are in the vicinity of Pearl lake.

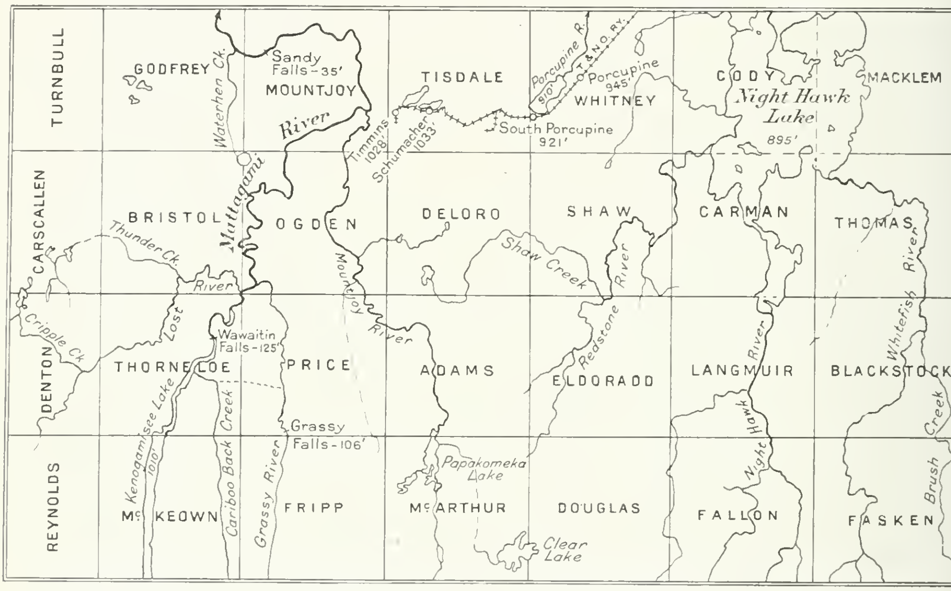
The principal towns of the area are Timmins, South Porcupine and Schumacher. The other townsites which have been established in what was thought favourable

locations have not been successful. The town of Timmins is most progressive, and is growing rapidly. The town is situated on a sand and gravel ridge overlooking the Mattagami valley, at an elevation of about 110 feet above the river.

To the northwest and west of Timmins a number of farms are being cleared along the Mattagami river. It is desirable to have a great part of the townships immediately north of the Porcupine gold area, which are in the clay belt, settled, as the farmers will have a near-at-hand market for their produce.

Access to the Area

A branch line of railway connects the Porcupine camp with the main line of the Timiskaming and Northern Ontario railway. The line from Porquis junction to Timmins is 33½ miles in length, and the distance from Timmins to Toronto is 485 miles. When through trains are running the journey requires about 20 hours.



Sketch map, scale 8 miles to 1 inch, showing townships in the Porcupine gold area and vicinity

Altitude of the Area

The Porcupine area has an average elevation of about 1,000 feet above sea level. In this respect it is similar to Cobalt, which lies about 100 miles to the southeast. Porcupine is on the Hudson Bay slope of Northern Ontario, whereas Cobalt is to the south of the height of land, and the waters drain into the St. Lawrence river. The divide between the Hudson Bay and St. Lawrence waters is not prominent, being usually less than 1,300 feet above sea level. The whole of northern Ontario represents one vast peneplain, cut by recent glaciation.

The highest elevation near Porcupine is along the south boundary of Jamieson township, where a felsitic ridge has an altitude of 1,350 feet above sea level. The hill of basalt immediately southeast of the Vipond mine has an elevation of 1,235 feet. From this hill a splendid view of the main gold area can be obtained.

The country from Night Hawk lake to the Mattagami river is one of low relief. Occasional ranges of hills reach an elevation of 150 feet, but, generally, abrupt changes in elevation are less than 50 feet. Often in a low area rocks outcrop only a few feet above the surrounding drift and are only a fraction of an acre in extent. Northwest, south, southwest and southeast of Porcupine lake the country is somewhat elevated, and rock exposures are more frequent than in most of the area.

The First Prospecting

In 1906 some work was done by prospectors on a vein near Miller lake and a few hundred feet from the present Hollinger veins. Evidently, seeing no gold, and having no assays made, they abandoned the property. In the same year claims were staked in Shaw township on what is described in the application as a " vein of sugar quartz and hematite iron." This is of interest since the so-called vein is simply the upturned edges of the Keewatin iron-formation.

In 1908 claims were staked by H. F. Hunter on the east shore of Porcupine lake. Gold was found sprinkled through the quartz and schist in a sheared zone.

It was not, however, until the following year that the spectacular discoveries of J. S. Wilson, on what is now the Dome property, caused a rush to the district, and in a few weeks practically all of Tisdale and a great part of adjoining townships and unsurveyed territory were staked.

Much work was performed during 1910 and 1911 in the townships near Porcupine lake, and while gold was discovered in a great number of places, it was not shown in the great majority of cases to be in sufficient quantities to warrant the erection of reduction plants. In the succeeding years there has been very little activity in the outlying parts of the area, but the success attending operations at the producing properties in Tisdale township may lead to further exploration. Such prospecting should be carried on with the object of finding large low-grade deposits rather than confining attention to the narrow high-grade veins, several of which have already been found in this area and have not been worked with success.

Forest Fires

Since the discovery of gold in this area there have been repeated forest fires which have destroyed much timber. The worst fires in recent years occurred in 1911. About the middle of May of that year a fire completely destroyed the surface plant and buildings of the Hollinger mine.

The greatest fire of the year occurred on July 11th, when, after a prolonged dry season, a hurricane from the southwest brought up a fire. The surface workings and buildings of the Dome, West Dome, Vipond, Standard, Preston, East Dome, North Dome and several other properties were entirely destroyed by fire. The town of South Porcupine was completely wiped out, and almost all the part of Pottsville which escaped the fire of July 2nd. The north part of Porcupine (Golden City) was also destroyed. This fire was attended by a great loss of human life, 71 in all having lost their lives either by being burned, suffocated or drowned. The destruction of the surface plants by this fire retarded the production of the camp for almost a year.

Timber

In the parts which have escaped the fires there is a dense growth of timber, including white and black spruce, jack-pine, birch and poplar. It is interesting to note that a growth of young tamarac is replacing the old tamarac trees, which have all been destroyed in recent years by the larch saw-fly. An occasional charred stump among the green timber, when gold was first found, showed that most of the forest is of second growth, the area having been ravaged by fires years ago.

Early Examination of Region

Previous to 1909, the area was little known. There were practically no reports upon it except from explorers and geologists who were attached to survey parties sent out by the Ontario Department of Lands, Forests and Mines.

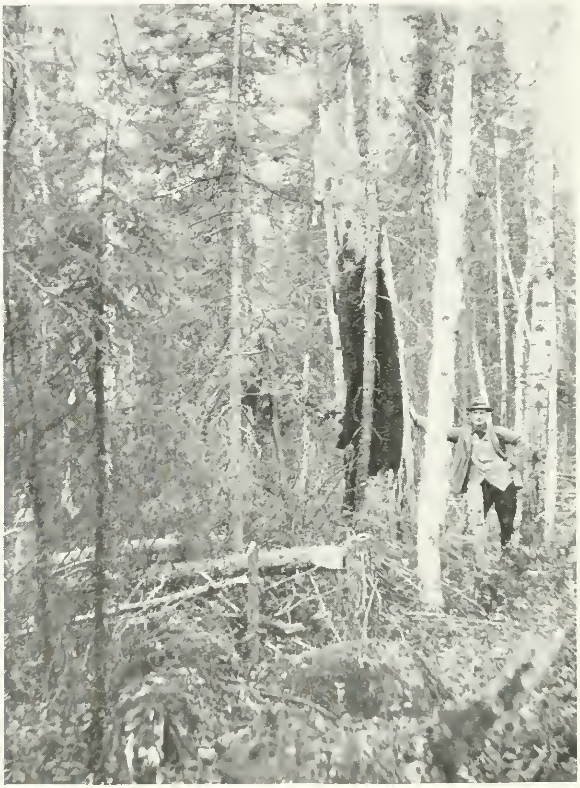
The main part of the camp is situated along an old portage route, from the Mattagami river to Night Hawk lake, which had been used by the Hudson's Bay Company officials for a couple of centuries.

In 1896 E. M. Burwash examined the country along what was then the Algoma-Nipissing boundary line which was run as far as the southeast corner of Whitney town-

ship in that year. He noted the occurrence of quartz veins, carrying traces of gold, at various points on the line. One of these veins he found on what is now the east boundary of Shaw, and only a few miles southeast of the main area. He remarked that the country was a promising one for the prospector but for the drift.[1]

Following the classification of the pre-Cambrian in use at that time Mr. Burwash grouped the Keewatin with the Huronian. He says:—

"In the lower part of the series [now considered to be mainly Keewatin] gold appears to be quite widely distributed both in veins which are of tolerably frequent occurrence and in mineralized portions of the rock itself. In two cases the veins were situated near the boundary of granite areas."



Relics of fire at Porcupine over 50 Years ago. Note spruce tree growing through old burnt red pine stub, Oct., 1911

In 1899 W. A. Parks reported on the geology of the portage route from the Mattagami river to Night Hawk lake by way of Porcupine lake. He, like Burwash, noted the occurrence of gold in some quartz veins, particularly in the southwest portion of Whitney township, obtaining assays from a trace to $1.00 per ton. In his summary Mr. Parks remarked: "I regard the region south of the trail to Porcupine lake as giving promise of reward to the prospector."[2]

Geological descriptions of areas, including and adjacent to the Porcupine area, are to be found in the reports of the Bureau of Mines for 1903, 1904 and 1905 by Messrs. Kay, McMillan and Kerr, respectively.

In October, 1909, Jas. Bartlett made a brief examination, for the Bureau of Mines, of the early discoveries of the area.[3]

[1] Bur. Min., Vol. VI. (1896). [2] Bur. Min., Vol. IX. (1900), Niven's Base Line. [3] Bur. Min., Vol. XIX. (1910).

Geology

The following legend refers to the rocks shown on the detailed map, No. 24d, accompanying the report:

Pleistocene	
GLACIAL AND RECENT	Boulder clay, stratified clay, sand, gravel, peat.
Pre-Cambrian	
KEWEENAWAN	Quartz diabase, olivine diabase.
(Intrusive contact)	
ALGOMAN	Granite-porphyry, feldspar-porphyry.
(Intrusive contact)	
PRE-ALGOMAN	Lamprophyre, serpentine, quartz-porphyry.
(Intrusive contact)	
TIMISKAMING SERIES	A series of conglomerate, interbanded slate and greywacké, quartzite, "carbonate" rock. The rocks are largely altered to schists.
(Unconformity)	
KEEWATIN	A complex of basic to acid, volcanics, agglomerates, ash rocks, iron-formation, rusty weathering "carbonate," diabase, serpentine, etc. These rocks are largely altered to schists.

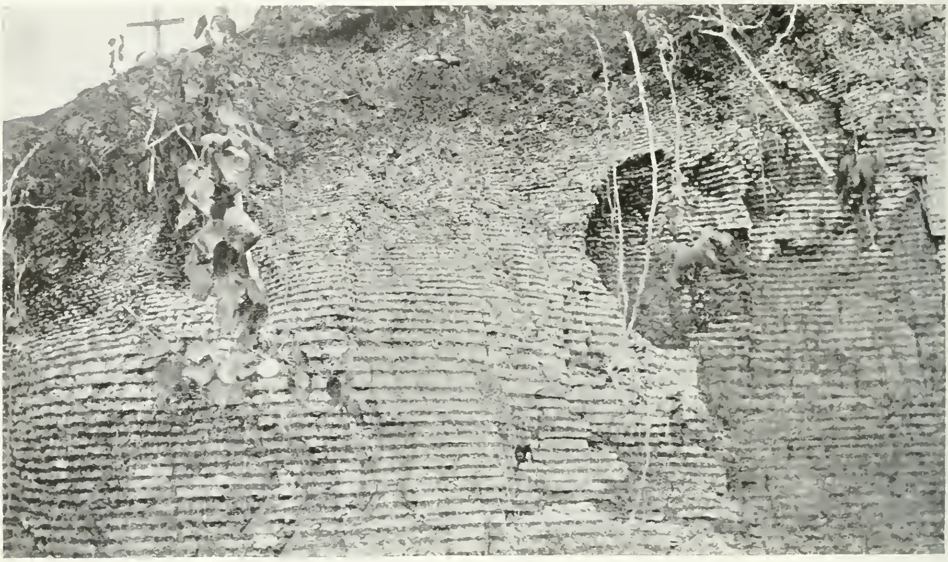
Pleistocene Deposits

The area is for a considerable part covered with drift. These deposits consist largely of stratified clays, sands and gravels, together with boulder clay. Sections of stratified clay overlain by sand are well exposed on the Mattagami river just north of Pigeon rapids, and along the shores of Night Hawk lake. Most of the islands in this lake have a rocky shore line, but are capped with well-stratified materials. The stratified clay is confined to the lower parts of the area, whereas the sand and gravel usually occur in prominent ridges. These ridges of sand and gravel are well seen in the west part of Deloro township and in the central part of Shaw township. A prominent sand and gravel ridge occurs in the town of Timmins, extending from the north shore of Miller lake in a southwesterly direction for some distance. J. Keele who had [4a] examined this ridge suggests that it is a kame deposit, formed from the wash of an ice sheet. This ridge is about 110 feet above the Mattagami river where the drift is stratified clay. To the east and southeast of the ridge there is an extensive deposit of sand.

Where the soil has been removed the rocks are seen to have been intensely glaciated. The fine-grained greenstones have well preserved the scratches and grooves produced by glaciation. On several islands in Night Hawk lake were noted two sets of striations S. 15° W. mag., and S. mag., the latter of which represents the later ice movement. Owing to the lack of drainage, much of the country, though higher than the rivers and lakes, is very wet, but would be suitable for agricultural purposes if properly drained. For a description of the agricultural possibilities of the country the reader is referred to reports by A. Henderson.[4]

[4] Agricultural Resources of Abitibi, Bur. Min., Vol. XIV. (1905); Agricultural Resources of Mattagami, Bur. Min., Vol. XV. (1906).

[4a] Personal communication.



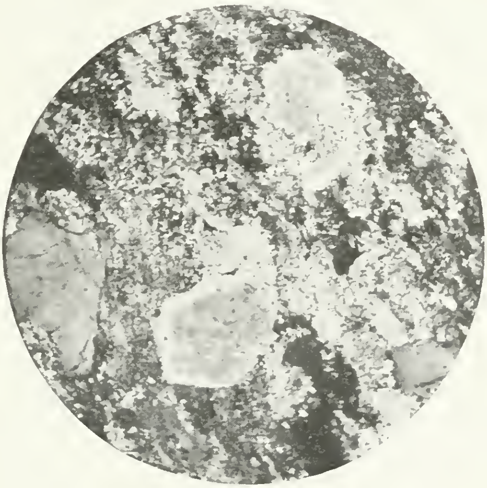
Stratified Clay at Sandy Falls, Mountjoy township

Ellipsoidal Basalt showing Amygdules. The hill is east of the Hollinger and north of the Porcupine Crown Mines

Keewatin

The rocks of Porcupine are largely igneous, and the greater part of them belong to the Keewatin. It is difficult to procure specimens of these old igneous rocks which are at all well preserved. In consequence, it is difficult, if not impossible, to make a close division of the Keewatin igneous rocks. Field evidence is abundant to show that the Keewatin is composed largely of volcanic rocks. At many places in the area where the Keewatin is exposed, the ellipsoidal or pillow lava structure has been beautifully preserved even though the original chemical and mineralogical character of the rock may have been completely destroyed. Examination of recent lavas has shown that the ellipsoidal structure is characteristic of basic to intermediate rocks which have a greater fluidity than the more acid lavas.

In the Kirkland Lake gold area, where Keewatin rocks are much better preserved than at Porcupine, both basalt and andesite have been recognized in rocks showing the ellipsoidal structure. Where the pillow lavas have been observed at Porcupine the original mineralogical texture appears to have been almost always destroyed. Occasionally small rods of altered plagioclase suggest a basaltic or diabasic texture.



Photomicrograph of volcanic rock, 300 feet north of main Millerton shaft. The rock is now largely altered to carbonate and chlorite. Scattered through the ground mass are large grains of quartz, some of which may represent original phenocrysts. No feldspars are recognized in the rock

Where the pillow lavas are exposed they usually occur in a general northeast and southwest direction, and roughly interbanded with them are other lavas which do not show the pillow structure. The lava with non-pillow structure is usually of coarser grain than the other and has a gritty texture on the surface. Frequently there is a well-marked line between these structures, and at other places the pillow structure seems to grade into the non-pillow structure. There is, however, a suggestion of a series of volcanic flows in the Porcupine area which largely make up the Keewatin. Some of the rocks which show the large " eyes " of quartz in hand specimens may represent rocks which are more acid than the basalts. Such a rock as this can be seen on the Krist claim about 800 feet south of the Porcupine Crown south boundary. The rock is greatly altered, but some of the feldspars can be distinguished as belonging to the more acid plagioclase. The rock may be a dacitic type of the flows.

Microscopic examination of numerous samples from areas which do not show the pillow structure throws very little light on the original character of the rock. A rock

from the South Porcupine-Timmins road, just south of the junction with the Rea mine road, is quite green in hand specimens. In thin section it contains coarse quartz grains and much leucoxene, while the feldspars are obliterated. The groundmass contains much chlorite, "carbonate," epidote, pyrite and iron oxide. A similar rock from 300 feet west of No. 1 shaft, Rea mine, shows in addition an intergrowth of quartz and feldspar while the groundmass is largely chlorite. Some of these rocks are evidently alterations of fairly basic varieties since an examination shows considerable chlorite and residual iron oxides. The following chemical analyses are of samples of rock which do not show the pillow structure but were taken from bands adjacent to the basalts:—

Photomicrograph of volcanic rock, probably dacite, 600 feet south of shaft, on Krist claim. The rock is largely altered but shows some of the phenocrysts of feldspar preserved. The feldspar crystal in the centre of the figure is albite. Quartz phenocrysts are abundant. The ground mass contains much carbonate sericite, quartz, chlorite, leucoxene, kaolin and micrographic intergrowths of quartz and feldspar

	1.	2.	3.
Silica	46.66	45.67	59.41
Alumina	15.47	19.94	14.85
Ferrous oxide	8.48	10.04	6.08
Ferric oxide	3.16	1.44	1.88
Lime	9.69	8.30	4.78
Magnesia	3.99	0.41	2.29
Potash	0.35	0.24	0.86
Soda	2.06	2.68	3.23
Water	4.27	4.66	3.12
Carbon dioxide	6.11	6.77	3.42

1. Rock from opposite the Rea mine road, Timmins-South Porcupine road.
2. 300 feet west of No. 1 shaft, Rea mine.
3. 800 feet south of No. 1 post N.E. ¼ N. ½ lot 9, con. 1, Tisdale.

A great part of the Keewatin rocks is now altered to schist, and such terms as grey schist, green schist, hornblende schist, carbonate schist are used to describe

certain rocks in various localities. These terms do not give much idea of the original mineral composition; for example, a grey schist may have been derived from a rhyolite or from a basalt. The terms grey schist and carbonate schist usually refer to a rock in which there is a high percentage of carbonate of lime, magnesia and iron. The rocks around the Hollinger mine, which are very much altered to schist, are referred to generally as grey schist. They contain considerable "carbonate," sericite, quartz and chlorite. An extreme alteration of an igneous rock to a schist is shown at the "blue" vein of the Millerton to the south of Miller lake. The ellipsoidal structure showing amygdules is still preserved, while the rock is a schist quite light grey in colour and with a high percentage of carbonate.

It does not therefore seem advisable to make any separation of the volcanic rocks of the Keewatin. They can be referred to as a basaltic greenstone series, which may include types of rock from rhyolite to basalt but are now generally so altered that a division is not advisable. They have all been subjected to vein-forming influences. There are also rocks throughout the Keewatin areas which are diabases and diorites. Some of these may be intruded into the volcanic type of Keewatin.

Some Keewatin Rocks in Tisdale Township

Rocks which are probably alterations from basalts are of frequent occurrence in this area. They may now properly be called meta-basalts. A very striking rock is seen on the prominent hill east of the Hollinger mine. The ellipsoidal structure is very conspicuous, being readily recognized from a distance. This structure is frequently three or four feet in diameter and the amygdules are often over an inch across, being white in colour and very striking against the light greenish matrix. These amygdules are frequently long in proportion to their breadth, having a cylindrical structure. This type of rock is to be seen southeast of the Vipond mine and at various places between this point and the Dome mine. The rock is quite readily recognized by its large ellipses, amygdules and rather mottled appearance. Other altered basalts occur frequently throughout the north part of Tisdale. Here the ellipses are smaller and less readily recognized, while the amygdules are small and pea-like and usually consist of calcite or quartz. This type of rock also occurs at the "blue" vein on the Millerton. An examination of an amygdaloidal rock from the 100-foot level of the Vipond mine shows it to be entirely decomposed. The amygdules are much stained with red iron oxide and show much clear calcite. Rims of chlorite surround the amygdules along which there are numerous grains of magnetite. A sample from the main shaft at the Dome Extension is quite schistose in thin section. Rods of plagioclase can still be recognized, while the ferro-magnesian mineral is entirely altered to chlorite. Quartz is present in small grains, and calcite is abundant in grains. Secondary feldspar is present in the form of clear grains. The rock may have been a diabase or basalt, but is now much altered. On the surface the rock has a green colour due to the abundant chlorite. It is probably a representative of the volcanic series. A chemical analysis of this rock gave: Silica, 49.88 per cent.; alumina, 15.29 per cent.; ferric oxide, 0.43 per cent.; ferrous oxide, 11.30 per cent.; lime, 4.54 per cent.; magnesia, 7.83 per cent.; soda, 2.17 per cent.; potash, 0.62 per cent.; carbon dioxide, 3.20 per cent.; water, 5.17 per cent.

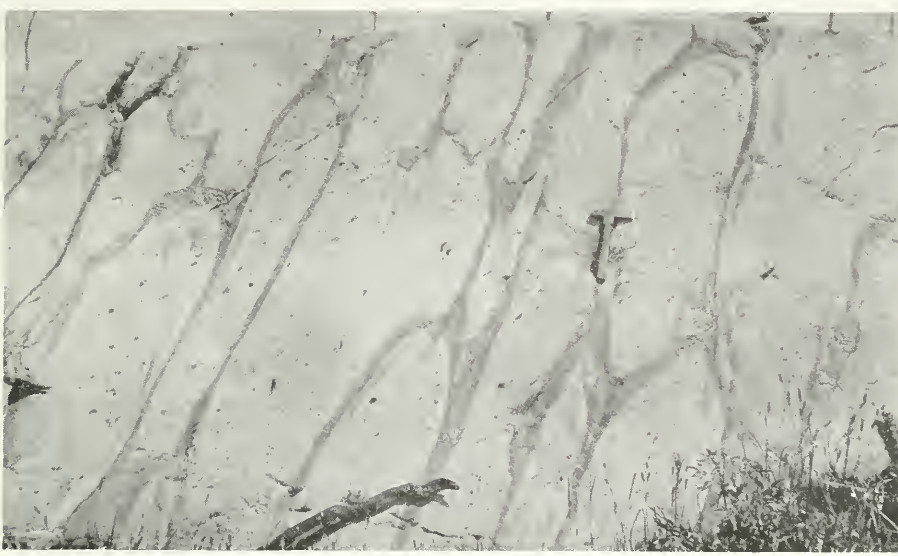
One-half a mile east of this there is a considerable exposure of diabase of varied grain. Examined in thin section it is shown to be considerably altered. The feldspar rods can still be recognized but their exact composition cannot be determined. The prominent mineral is hornblende which is partly altered to chlorite. There are also a few grains of quartz, evidently original constituents. Much of the rock just west of the diabase shows the ellipsoidal structure, and there appears to be a transition from the basalt to the diabase, the diabase probably representing a thick portion of a flow.

Agglomerate north of Porcupine Crown Mine

The rock from the boundary between Whitney and Tisdale, about the middle of the fourth concession, is a fine-grained amphibolite, consisting essentially of hornblende, epidote, zoisite and calcite.

The rock from the main shaft of the Davidson is dark green in colour and shows blades of dolomite. In thin section the groundmass appears to be largely composed of chlorite, through which are numerous feldspar rods. In the groundmass are scales of sericite, grains of quartz and numerous large crystals of dolomite. Much of the greenstone along the veins of north Tisdale is greatly altered to impure carbonate rock, but in the sample just mentioned an igneous texture is quite distinctly recognized and the rock is considered to be an altered member of the volcanic series. A similar rock to this occurs south of the power house at the Crown Chartered, the adjoining property.

A greenstone, north of the quartz-ankerite veins on the Gray claims in Ogden township, which shows a rough ellipsoidal structure, is very similar to the rock from the Davidson.



Type of pillow lava associated with the iron formation series, M.E. 56, Deloro township

A spotted rock, from the northeast part of the West Dome in lot 5 in the first concession of Tisdale, is probably an altered amygdaloidal lava. The schistose matrix consists of secondary material, dolomite, sericite, etc., and the amygdules, whose margins are stained with limonite, are filled with calcite, sericite, and quartz. Some of the amygdules are an inch in length.

The schist near the old No. 1 shaft of the Hollinger mine is fine in grain and of a light grey colour. The groundmass consists essentially of sericite (or talc), dolomite, quartz and feldspar. In this occur round and irregular eyes of quartz, which may represent phenocrysts in the original volcanic rock from which the schist has probably been derived. Cubes of iron pyrites are commonly set in the rock. The somewhat massive rock exposed just southeast of Miller lake is made up of a fine-grained matrix of quartz, feldspar and sericite in which are set small phenocrysts of quartz and feldspar. The rock is much impregnated with dolomite.

A sample of schistose rock from the 140-foot level of the Bewick-Moreing shaft, east of Pearl lake, shows an abundance of sericite, chlorite and calcite, with numerous quartz grains. The rock is entirely altered, but some of the quartz grains may be remnants of phenocrysts. These last mentioned rocks are probably alteration rocks from the less basic members of the volcanic series.

Keewatin Rocks in Whitney, Shaw and Deloro Townships

There is a series of rocks outcropping in the southwest portion of Whitney, in most of Shaw and the greater part of Deloro township which differs greatly from those which form the large part of Tisdale township. This series consists of fine-grained greyish and greenish schists, some of which show water-sorted bands, rusty weathering carbonate, iron formation, agglomerate, ash rocks, pillow lavas and other igneous rocks. The series contains a high percentage of fragmental rocks, in which respect it is different from the volcanic series in Tisdale. The bands of iron formation occur at different horizons in this series, being sometimes underlain and at other times overlain by other rocks of the series. In Whitney township individual bands of iron formation can be traced in anticlinal and synclinal folds, and field evidence shows that there are several bands of the formation. Frequently fragments of iron formation and other rocks occur in the agglomerates in Shaw and Deloro. These fragments are abundant in the agglomerate band outcropping on mining claim M.E. 19, Shaw township. The typical pillow lava of the series is well exposed on claim E.D. 356, which is on the wagon road two miles south of South Porcupine.

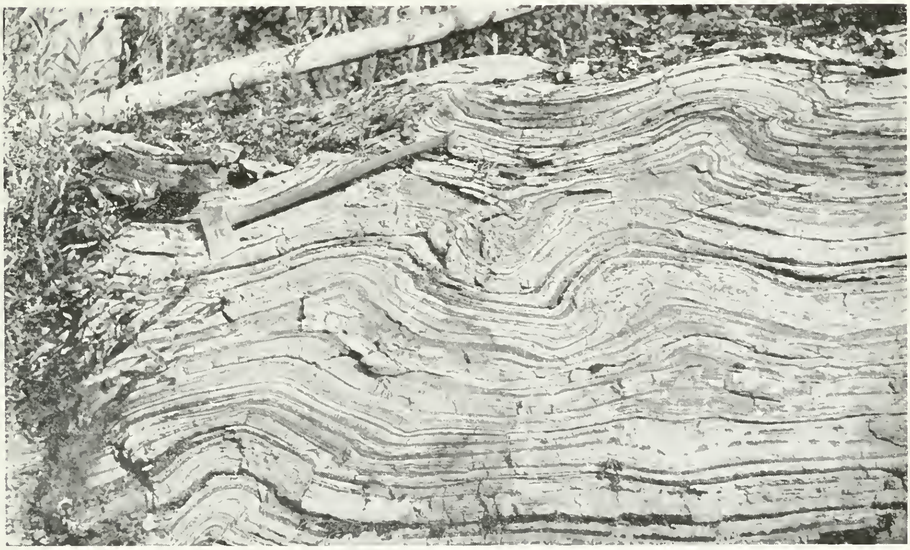
Fine grained ash rock with the iron formation showing bedded structure, Lot 9, south boundary of Whitney township.

A number of green dikes are associated with these rocks throughout Deloro and Shaw. These are usually less than 100 feet in width and they cut the banded iron formation. The rock is completely altered, the predominating mineral being chlorite which gives the green colour to the rock. Other secondary minerals are calcite, quartz and kaolin. Some of these dikes occur on mining claims E.D. 356 and H.R. 987, Shaw township.

Iron Formation

Iron formation outcrops frequently in the southwest portion of Whitney township and also in Shaw and Deloro townships. The formation is usually narrow—from a few feet up to 50 feet in thickness, consequently the extent of the outcrop depends on the dip of the strata. In Whitney the iron formation frequently is nearly flat-lying, hence there are exposures several hundred feet in width. In other townships the dip of the formation is usually about 60°, consequently the outcrops are narrower. The iron formation consists of alternate layers of reddish to greyish silica and magnetite

Agglomeratic rock containing bomb-like inclusion, H. R. 984, Deloro township. This rock is associated with the banded iron formation



A crumpled portion of banded iron formation showing the grey silica interbanded with magnetite and some hematite, northwest corner Penny veteran claim, Whitney township

or hematite, magnetite being the principal iron ore. The bands are sometimes greatly brecciated in one portion and less disturbed in another. The narrow layers of iron ore, one-eighth or more of an inch in thickness, are often pure magnetite. The amount of iron in the iron formation varies greatly in parts of the area. That which has the greatest percentage of iron is in Whitney township. A selected sample of the iron formation carried 35.2% metallic iron. It is doubtful, however, whether at any place the iron is sufficiently concentrated to produce commercial ore. The outcrops containing the greatest percentages of iron are in lots 9, 10 and 11 in the first concession of Whitney township. In lots 5 and 9 in the second concession of this township there are outcrops of the formation in which iron pyrites replaces the magnetite, the alternating bands being sugary quartz and pyrite. A sample of the banded silica and iron pyrites gave 40 cents per ton in gold.

Where the formation has been greatly disturbed quartz veinlets have been formed and these sometimes carry gold. Considerable work has been done in Deloro and Shaw on such deposits.

Carbonate Rocks

In various parts of the area associated with Keewatin rocks are carbonates to which various terms have been applied, such as: dolomite, ferro-dolomite, ferruginous carbonate and ankerite.

There is much uncertainty as to the origin of this rusty carbonate rock in different parts of the area. The carbonate may occur in at least four different forms, namely, as original bedded material, as a replacement, as vein filling, and as a decomposition product of basic, igneous or other rocks.

Willet G. Miller, in his notes with the first edition of the Porcupine map, states that certain dolomites of the area may correspond to the crystalline limestone of eastern Ontario. Further he says: "It would appear not unlikely that carbonate in some places is a replacement mineral, and that a considerable volume of rock may at times have been replaced by carbonate."

In the township of Whitney there are bands of carbonate closely associated with bands of iron formation. The relationship would suggest a similar origin for these rocks, that is, as beds deposited in sea water and now resting in an inclined position dipping to the north. These dolomite bands are frequently intersected with quartz veinlets, carrying some gold values, hence their importance. The bands have recrystallized and carry veinlets of later carbonate, as well as quartz.

In the northeast part of Tisdale and the adjoining part of Whitney, there is considerable rock which carries a high percentage of carbonate. This impure carbonate rock is much fissured by quartz veins, as on the Armstrong-McGibbon, lot 1 in the fifth concession of Tisdale, and other properties in the vicinity.

Several samples of rock which effervesce strongly with acid show an original igneous structure under the microscope. A sample from near one of the Davidson veins on the southwest quarter of the south half of lot 2 in the fifth concession of Tisdale is a medium-grained, greenish, much altered igneous rock. Plagioclase feldspar, showing albite twinning, may still be recognized, and also micrographic intergrowths of quartz and feldspar. The remaining minerals are secondary—chlorite, calcite, etc., and make up a large part of the rock, which is probably a quartz-diorite or grano-diorite. Another rock, taken from a cross-cut at 90 feet depth, on the Scottish Ontario property, is an altered basalt. The plagioclase feldspar is largely altered to saussurite minerals, while the ferro-magnesian mineral has gone to chlorite, and magnetite to leucoxene. Calcite is present in considerable quantity as a secondary mineral. Other examples could be cited showing the replacement of igneous rock by carbonate. It is believed that this process has continued in some cases to such an extent that the rock is now largely carbonate, while the original rock constituents are leached out, or so altered as to show little trace of the igneous origin.

Analyses were made of some impure carbonates which occur with the quartz veins in northeast Tisdale, with the following results:—

——	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Insoluble	51.82	58.63	47.35
Calcium carbonate	19.38	19.59	20.98
Magnesium carbonate	6.08	8.06	8.50
Ferrous carbonate	13.49	11.53	12.19

No. 1 is an impure carbonate from near the west end of the main quartz vein on the Davidson claim, N.W. ¼, S. ½, Lot 2, Con. 5, Tisdale.
No. 2 is from the south wall at the east end of this vein and is quite schistose.
No. 3. is from the Crown Chartered property—just northwest of No. 1 shaft.

Similar impure carbonates occur at the Armstrong-McGibbon, Scottish Ontario and other properties near by, and also in other parts of the area—as at the Rea vein, lot 6 in the third concession of Tisdale. Microscopic examination of the above rocks shows them to be entirely secondary. There is an abundance of sericite and a minor quantity of quartz present in the sections.

That there has been considerable migration of carbonate solutions is shown by the manner in which almost all the rocks of this area are more or less impregnated with it. Sections of quartz-porphyry schist show the presence of much calcite as a secondary mineral. Veins and veinlets of ankerite occur frequently, not only in basic rocks, but in the quartz-porphyry.

The origin of some of the ankerite bands, such as are seen in the Curts " vein " on the West Dome properties is difficult to explain. Analyses of samples of this ankerite, show it to be almost free from insoluble impurities, in which respect it is quite different from the carbonate occurring in northeast Tisdale. The distinct walls of the band of carbonate suggest a vein or bed origin for it rather than a replacement. Analyses of carbonate from different parts of the Curts vein are given in columns 1 and 2.

——	1.	2.	3.	4.
	Per cent.	Per cent.	Per cent.	Per cent.
Insoluble	1.73	....	11.42	....
Calcium carbonate	50.63	51.28	46.63	42.76
Magnesium carbonate	29.57	29.82	28.77	19.86
Ferrous carbonate	14.15	14.70	5.39	12.01

No. 3 is an analysis of ankerite from a narrow vein on the West Dome.
No. 4 is an analysis of a very dark grey ankerite from a vein at the Hollinger Reserve mine. Ogden township.

The impure carbonates may have resulted in some cases from a direct alteration of basic dikes. What is known as the Powell carbonate band, on M. E. 20 in Deloro township, contains considerable serpentine and a chrome mica which could well come from a chromiferous peridotite. In the south part of the same township, on P. P. 57, there is a carbonate rock which is about 100 feet wide. It consists principally of carbonate and serpentine, through which ramify many veinlets of almost pure magnesite. All these minerals are cut by veinlets of quartz. An analysis of the magnesite gave: $CaCO_3$ 0.48;

$MgCO_3$, 80.25; $FeCO_3$ 2.46. Robert Harvie ascribes such an origin for the rusty carbonate bands of the Opasatika Lake area in Quebec.[5]

On the other hand it is likely that a great number of the almost pure ankerite veins of the area have been formed from circulating waters as suggested above.

Similar Rocks in Other Areas

Carbonate rocks are characteristic of all the gold-bearing areas of northern Ontario.

Larder lake, which lies about 70 miles east-southeast of Porcupine, is referred to by Mr. R. W. Brock as follows:

Rusty weathering Keewatin rock which has been fractured and now shows irregular quartz veinlets. Mining claim LO 327, Deloro township

"The most interesting rock from an economic standpoint near Larder lake is a rusty weathering dolomite (?). About 60 per cent. of the rock consists of lime-magnesia—iron carbonate, the remainder of quartz and a soft green talcose silicate, probably serpentine. The origin of the rock is as yet a little uncertain. Certain dikes, when squeezed and altered, produce a rock which bears a strong resemblance to it, but its occurrence with slates and phyllites and with the cherts—undoubted sedimentary rocks—as a conformable band . . . render it more probable that it is an altered stratified ferriferous dolomite, probably forming a member of the iron ore formation. This rock, especially where cut by the porphyry or pegmatite . . . . is traversed by innumerable stringers of quartz which in places are gold-bearing."[6]

M. E. Wilson also refers to Larder lake, and to Opasatika lake to the east, as follows:

[5] Journal of Canadian Mining Institute, Vol. XIV., p. 187. [6] Bur. Min., Vol. XVI. (1907), p. 207.

"In the neighbourhood of Larder lake and north of lake Opasatika are local outcrops and bands of a rusty-weathering rock consisting of ferruginous dolomite or ankerite, with varying quantities of quartz and feldspar. It is always highly pyritic, and in most localities contains a large amount of chrome mica or fuchsite from which the rock derives its colour. As a rule the rock is cut in a most complex manner by two or more sets of veinlets of quartz or of quartz and ferruginous dolomite, the dolomite occurring along the margin of the veinlet and the quartz in the centre."[7]

M. B. Baker describes a similar carbonate rock in his report on the Abitibi Lake area,[8] and also A. A. Cole in his report on the gold-bearing deposit at Gold island in Night Hawk lake.[9]

Some of the gold deposits on Timagami lake are associated with the carbonate.

W. G. Miller refers to these in his report on "The Iron Ores of Nipissing District":

"At Ferguson point a pit has been sunk in quartz and dolomite. The appearance of these two minerals in association is interesting as the mixture of the two resembles closely the gangue of some of the auriferous mispickel ore bodies in Hastings county. There are some other masses of more or less silicious dolomite along this (northeast) arm of Timagami, in Emerald lake and elsewhere."[10]

A. L. Parsons describes a carbonate as occurring at the Regina mine, Lake of the Woods:

"No. 3 vein is principally quartz, though in places a good percentage of a rusty carbonate is found intermingled with the quartz. The west vein, which is about 20 feet wide, consists of two parts, that upon the north being quartz interbanded with rusty carbonate, while the southern portion consists entirely of this rusty carbonate."[11]

In the same area at West Shoal lake, A. P. Coleman describes the veins at the Oliver Daunais location as quartz mixed with a good deal of dolomite. In some cases the latter mineral contains a few specks of free gold.[12]

Carbonate rocks are also associated with iron ore deposits in northern Ontario, as at Helen mine, Michipicoten. In this locality there are masses of siderite impregnated with iron pyrites, from which, according to A. P. Coleman, the hematite ore has been derived.[13]

It will be seen that the carbonate rocks of the pre-Cambrian have a wide distribution in northern Ontario. They vary considerably in composition, but are represented for the most part by crystalline limestone in which $CaCo_3$ predominates. Other carbonates are ankerite, siderite and dolomite. In one locality the crystalline carbonate has the composition of magnesite.

A strikingly green colour is often seen in the ferruginous carbonate rocks of the area. It is well shown in these rocks on Night Hawk lake. N. L. Turner, ex-Provincial Assayer, obtained decided reactions for chromium in a sample from Night Hawk lake, suggesting the presence of a chromium silicate. M. E. Wilson describes a similar green mineral from Opasatika lake as a chrome mica.

A similar mineral has been reported to occur on Abitibi lake and elsewhere.[14]

A chrome-magnesia mica (biotite) occurs in the township of Hyman, Sudbury district.[15]

Fragmental Rocks

At the lower end of the third sandy portage on the Mattagami river below Timmins landing, the rock is schistose, and is made up of bands of coarse and fine material which tail out like sedimentary deposits. This rock, however, may be composed of volcanic fragmental material which has been water-sorted.

At the middle and upper sandy portages, the rock has a fragmental appearance in the field, but C. W. Knight, from an examination of thin sections, suggests that

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[7]Sum. Rep. Geol. Sur. Can., 1909. [8]Bur. Min., Vol. XVIII. (1909), p. 270. [9]Ibid., Vol. XVI. (1907), p. 220. [10]Ibid., Vol. X. (1901). [11]Ibid., Vol. XX. (1911). [12]Ibid., Vol. VI. (1896), p. 105.

[13]Bur. Min., Vol. X. (1901), p. 193. [14]Ibid., Vol. XVI. (1907), p. 219. [15]Rep. Geol. Sur. Can., Vol. VI. (1892-3), p. 27 R.

such rocks may have been originally quartz-porphyry, which is now much crushed and impregnated with carbonate. One sample contains somewhat rounded grains of quartz and feldspar in a fine interlocking matrix of quartz and feldspar, with sericite and calcite.

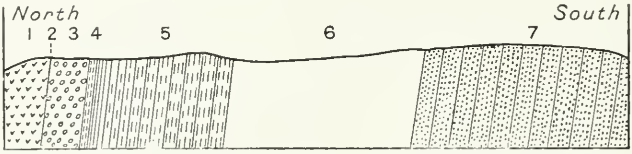
On the south boundary of Jamieson in lot 7, about 4 miles northwest of Sandy falls, there is a volcanic rock, now somewhat schistose, but the porphyritic character of which is distinct, with phenocrysts of clear quartz in a dense grey felsitic groundmass. The rock described at Sandy falls may be similar to this, but more highly altered.

Post-Keewatin Sedimentary Rocks

Two series of sedimentary rocks later in age than the Keewatin occur in the Porcupine area. Of these, the older is the Timiskaming series, which is of great importance, while the younger is the Cobalt series, which is unimportant.

The Timiskaming Series

This series of rock is prominent in the townships of Tisdale and Whitney. It is traceable by means of infrequent exposures from the vicinity of the Dome mine to the north shore of Night Hawk lake. To the east of Night Hawk lake the country is



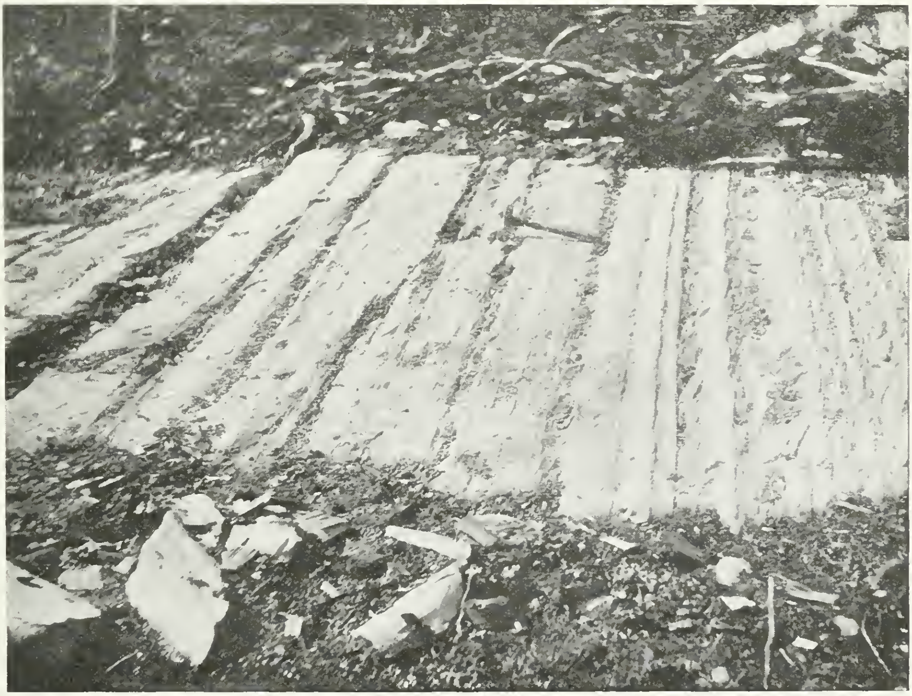
Section of Timiskaming series. Lot 5, Con. V., township of Whitney. Scale : 1000 feet to 1 inch.

1. Keewatin pillow lava.
2. Concession line.
3. Conglomerate.
4. Very fine slate band.
5. Greywacké with alternating bands of thin slate.
6. Drift-covered area.
7. Very coarse arkose-like quartzite.

heavily drift-covered. Sedimentary rocks similar to those of Porcupine are seen in Beatty and Munro townships, which lie to the east of Matheson station, about 40 miles from Porcupine, and again at Kirkland lake where many of the gold-bearing veins occur in schistose conglomerate and greywacké. The rocks of the series are in areas which have their greater dimensions in a general east and west direction, as will be seen from the maps of the Porcupine and Kirkland Lake areas. The great folding and deformation of these older rocks occurred when the great compressive forces were acting chiefly in a north and south direction. Consequently the Timiskaming series was folded with the Keewatin. Erosion has destroyed a great portion of the Timiskaming series, and comparatively narrow bands of the series have beeu preserved in the depressions in the Keewatin. The band of Timiskaming rocks at Kirkland lake has a somewhat crescent outline, while that at Porcupine, which is probably continued easterly to Munro township, is somewhat parallel to it.

A contact of the sedimentary rocks with the volcanic rocks can be seen immediately south of the open pit at the Dome mine. Fragments of the volcanic series are abundant in the sedimentary series, and it is likely that the conglomerate has been deposited on the surface of the volcanic series of the Keewatin. There are also remnants of conglomerate along the ridge directly northwest of the Dome Extension mine. In this locality a few pebbles of altered granite were observed in the conglomerate. Again at the Three Nations Lake mine, where the conglomerate is to the south of the volcanic series, there are inclusions of pillow lava in the conglomerate, suggesting that the conglomerate is younger than the pillow lavas. Here the conglomerate-lava

Crumpled rocks at base of sedimentary series on the south part of Dome property, Sept. 1911



Interbedded quartzite and slate of the Timiskaming series showing secondary cleavage, North Dome mine, Oct., 1911

contact dips steeply to the north. However, one half a mile northwest of the north end of Porcupine lake, in lot 11 in the fourth concession of Whitney, there is a contact of the sedimentary series with pillow lava in which the relationship suggests an igneous contact, that is that the pillow lava is later than the sedimentary rock. It is therefore probable that some of the pillow lavas mapped with the Keewatin are later in age than the Timiskaming series.

The Timiskaming series consists of conglomerates, interbanded slate and greywacké, and quartzite. The rocks for the most part have been altered to schistose derivatives. The beds are in a highly inclined attitude varying from about 70° N. to vertical. The general strike of these beds around the North Dome and nearby properties is about N.E. and S.W. The cleavage planes are quite clearly shown to intersect the bedding planes and are in a more nearly east and west direction. Where the slate-greywacké rocks occur, the original bedding is quite plainly recognized in the alternate dark and light-coloured beds. This sedimentary structure is well shown around the North Dome. Here the slate-greywacké beds are lying against a bed of conglomerate about 200 feet in thickness.

A section of the Timiskaming series south of Dome mine, showing conglomerate overlain by greywacke and thin beds of conglomerate. The rock carries a considerable proportion of carbonate

The sedimentary rocks at the Dome mine have been greatly altered, occurring as they do along a sheared zone impregnated with quartz. In the large open pit at this mine the fragmental character of the rock can be observed, particularly along the south edge where the rock is a conglomerate. In this conglomerate there is considerable variety of included fragments, such as greenstones of varied types, light-coloured quartz-porphyry, felsite, sugary iron formation and quartz. The matrix of the conglomerate is now quite schistose, and in some of the freshly broken rock, unless light-coloured fragments are present it is difficult to recognize the conglomerate character. To the east of the main hoisting shaft there is some extremely fine-grained slaty rock which breaks in fissile slabs. This same rock is observed in the easterly workings of the mine.

The sedimentary rocks in the vicinity of Three Nations lake are much less altered than those around the Dome mine. The succession of strata is well shown at the property of the Three Nations Lake Mining Company, on lot 5 in the fifth concession of Whitney. Along the line between the fifth and sixth concessions very much altered

Keewatin rocks, now largely pillow lava and rusty weathering serpentinous carbonate, are exposed. The contact with the Timiskaming conglomerate practically follows this line. In the basal conglomerate are numerous fragments of rusty-weathering Keewatin rocks, while farther south there are numerous pebbles of acid rocks, including quartz-porphyry, felsite, and other varieties. South of the conglomerate there is a narrow band of fine-grained black slate, which is quite fissile. South of the slate there are greywacké and slate in alternate bands becoming coarser towards the south. About one-half a mile south of the concession line the rock is quite coarse-grained and may be called arkose-like quartzite. The sedimentary rock around Three Nations lake, except that it is now standing on edge, somewhat resembles the Cobalt series.

On the Foley-O'Brien claim just south of the Timmins-South Porcupine road, there is an incomplete section of the Timiskaming series showing 155 feet of interbedded slate and greywacké, 65 feet of conglomerate, 30 feet of interbedded slate and greywacké, 440 feet of conglomerate. The interbedded slate and greywacké is a very interesting rock showing successive alternations of fine-grained, dark grey and coarse-grained light grey beds. Of these the fine slate beds are the narrower, often only a fraction of an inch in thickness, whereas the coarse-grained beds may be several feet in thickness. In some of the interbedded material there can be recognized a gradation in grain from very fine clay material in the slate bands through a fine-grained more sandy to a fairly coarse gritty material in the light grey bands, followed by a repetition of these conditions in another set of bands. This structure is evidence of a thorough water-sorting of material in part of the Timiskaming series.

In addition to having a more or less vertical attitude, the beds of the series are often crumpled, the result of pressure in an east-and-west direction. This structure can be observed on the Foley-O'Brien property. Small anticlinal and synclinal structures were also observed in the series north of the Dome road about one-quarter of a mile from the Dome mine.

Greywacké with strike east and west and dip 85° N. occurs on the N.E. shore of Night Hawk lake. In the greywacké are thin beds of conglomerate containing pebbles of dark green Keewatin rock, numerous quartz pebbles and some felsite. Some of the pebbles are six inches in diameter, which is larger than the average of the pebbles in the conglomerate. A sample of the greywacké examined under the microscope consists of angular fragments of quartz and feldspar with finer particles of the same materials and chlorite, sericite and limonite. Altered sedimentary rocks outcrop at Wawaitin falls on the Mattagami river. These rocks have been greatly metamorphosed, but conglomerate, quartzite and slate can be recognized. Some bands of rusty weathering carbonate occur with the sediments. Similar rocks occur in Bristol township and at several points along the Mattagami river north of Wawaitin falls.

The rocks of the Timiskaming series have been greatly impregnated with carbonate solutions, so that many of them are now largely carbonate, effervescing freely with acid. In this respect these rocks differ from those of the Cobalt series, which are on the whole fresher and harder rocks.

J. G. McMillan has recognized a group of altered sediments dipping at high angles in Midlothian township, about 40 miles south of Porcupine, which he has classified as Timiskaming.[16]

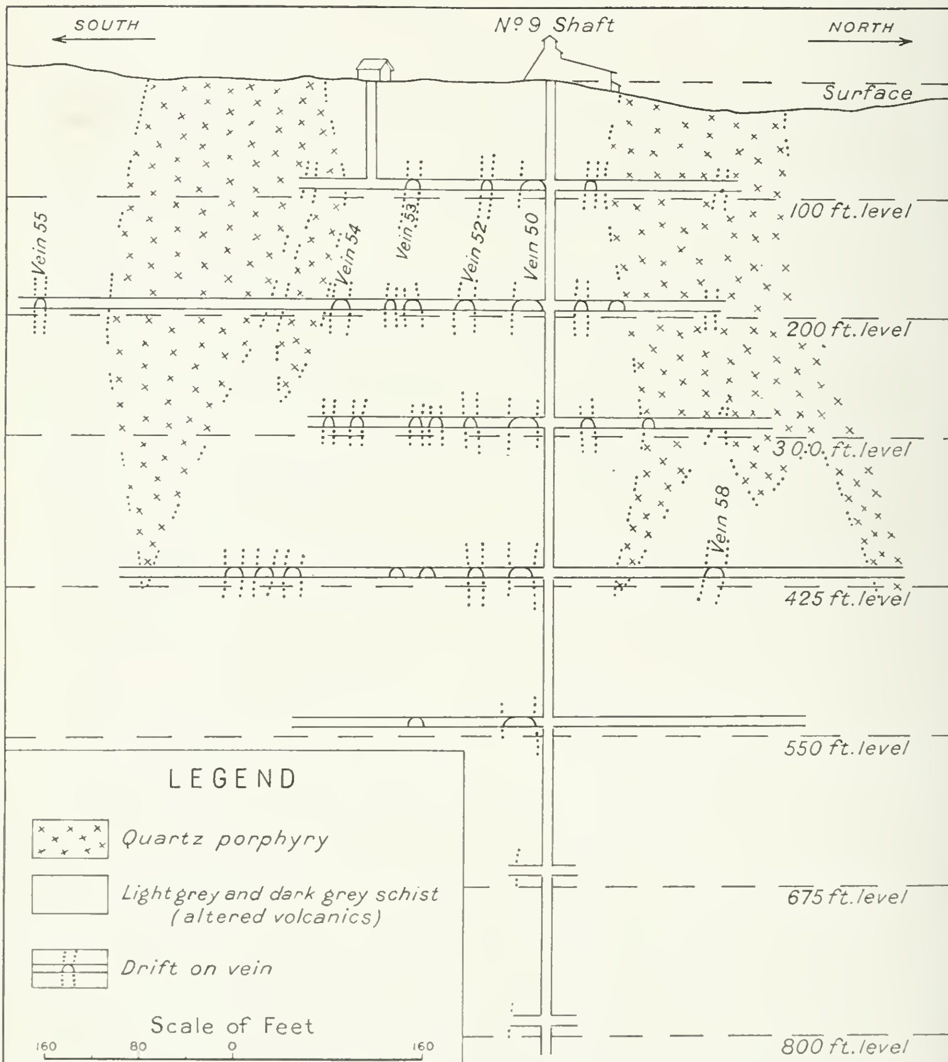
While there is much evidence pointing to a separate sedimentary series of rocks, the possibility of some of what has been called Keewatin being contemporaneous with the Timiskaming, or of some of the sediments being of Grenville age must be considered. Toward the southwest from the open pit at the Dome mine there is a narrow band of conglomerate which has been mapped as Timiskaming. Much of the material in this band, immediately north of the readily recognized pillow lava and amygdaloidal rock, resembles volcanic fragmental or agglomerate. There is no break, however, between the apparent volcanic fragmental and the interbedded slate and greywacké which

[16] Report of the Geology of the Area along the T. & N. O. Railway Trial Line between Gowganda and Porcupine, 1912.

occurs along the south margin of the open pit and which can be followed northward for a mile. If the rock above mentioned is a volcanic fragmental and not a true conglomerate deposited on an eroded surface, then there is reason for considering the pillow lavas, fragmental rocks, slates, greywacké and conglomerate as belonging to one series. For lithological reasons it seems preferable to consider the large area of sediments as a separate series. Economically the series of sediments has the same importance as the volcanic series, since it has been subjected to the same gold-bearing vein influences.

Quartz-Feldspar Porphyry

An intrusive rock, generally of a light grey colour, occurs in many parts of the Porcupine area. It is readily recognized in the field by its light colour, coarseness of



A north and south vertical section across the vein system of the Acme mine, illustrating the "chonolith" form assumed by the quartz-porphyry

grain, frequent phenocrysts of glassy quartz, and white and bleached phenocrysts of acid plagioclase. In most localities it has been altered to a schist, particularly in the vicinity of the McIntyre, Acme and Dome mines, but, even when very schistose, it is readily recognized. An examination of the map will show that the rock is quite prominent to the southwest of Pearl lake and to the south of the Dome mine. It occurs sometimes as definite dikes, as at the Dome Extension, where dikes only twenty or thirty feet in width are traceable across a claim. The usual occurrence is in broad, irregular masses which have been exposed by erosion. It will be seen from the map that the outcrops of the porphyry in the vicinity of the Hollinger are elliptical in shape. It is quite likely that other masses occur throughout this area which have not yet been exposed by erosion.

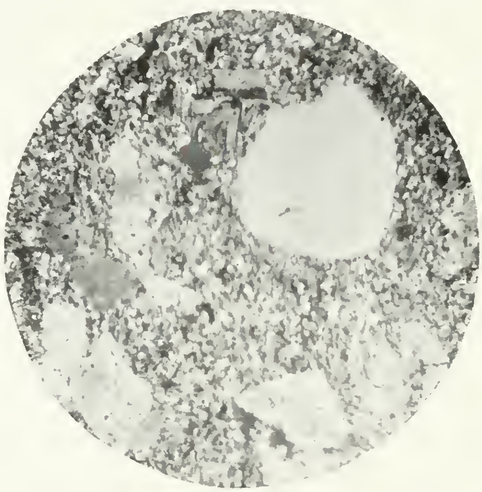
Quartz-porphyry containing inclusions of other rocks, Porcupine Crown mine. The fragments have escaped assimilation by the porphyry. The large inclusion in the foreground contains well developed crystals of albite

None of the ordinary terms which are used to describe masses of rock which are injected into other rocks seem to be suitable to describe these irregular masses of quartz-porphyry. The term "stock," which might seem suitable, is not satisfactory, owing to the fact that some of these masses are shown by mining operations to become quite narrow at depth. The term "chonolith," proposed by R. A. Daly as a name for these irregular intrusions, would seem to be a satisfactory one for these porphyry intrusions.

In several of the outcrops of this rock there are inclusions of dark volcanic and other fragments which have been caught up by the porphyry magma during its intrusion. Where these fragments are plentiful, as in the outcrops near the Porcupine Crown mine, the erosion of the porphyry has probably not extended much below the original roof of the porphyry intrusion. Directly north of the main shaft of the Porcupine Crown the contact between the porphyry and the dark volcanic rock is very indistinct, with a transition zone of several feet between readily recognized porphyry

and greenstone. The field evidence suggests the assimilation of the greenstone by the porphyry along the contact, but the rocks are too greatly altered to prove this by a chemical analysis.

Again, along the contact of the porphyry and the greenstone (basalt, etc.), there is frequently a conglomeratic looking rock in which there are fragments of porphyry in addition to fragments of greenstone. Its origin is very uncertain. It has characteristics of an agglomerate since it seems to occur in bands wth the volcanic igneous rocks, but this would necessitate the fragments of porphyry having been derived from a pre-existing quartz-porphyry. The fragments of porphyry appear to be similar to that which occurs in the vicinity in place. Another explanation of the formation of the rock is that the porphyry intruded the greenstone when it was in a schistose condition. The two rocks were then subjected to brecciation, and now resemble a conglomerate. The conglomeratic appearance is sometimes noted in the porphyry itself, as in the mass immediately north of the Dome mine, where the whole rock is porphyry with pressure lines developed through it. In the alteration of the porphyry there has been a development of sericite schist in many parts of the area.



Photomicrograph of quartz-porphyry from area south of Dome mine. Phenocrysts of quartz and feldspar may be seen in a fine-grained groundmass of quartz, feldspar and chlorite

The following table, giving the chemical composition of the porphyry, will show that it is of intermediate composition and has a much greater percentage of soda than potash. The ferro-magnesian minerals are practically absent. The rocks consist of phenocrysts of quartz and feldspar in a groundmass of similar minerals. The secondary mineral sericite or paragonite is present in considerable quantity in most of the thin sections examined.

Owing to tho high precentage of soda relative to potash in the analyses one would expect a considerable portion of the secondary hydrated mica produced by alteration to be the mineral paragonite, a hydrated sodium mica. The occurrence of these secondary micas in most minute scales renders the exact determination of sericite or paragonite difficult, hence much of the sericite mentioned in descriptions may really be paragonite.

	1.	2.
Silica	65.22	67.64
Alumina	14.62	18.68
Ferric oxide	3.39	1.80
Ferrous oxide	1.14	1.38

	1.	2.
Lime	3.01	0.39
Magnesia	1.09	1.04
Soda	5.66	4.16
Potash	1.45	1.61
Carbon dioxide	2.61	trace
Water	1.07	1.92
Sulphur	0.79	1.71

(1) Preston claim, Deloro township. (2) South of Dome mine.

The quartz-porphyry in the description given above is considered to be a hypabyssal rock, that is, intermediate between the deep-seated plutonic and the surface volcanics, and of the nature of an intrusive.

Megascopically the porphyry is of a light greyish to greenish colour. The phenocrysts of quartz are well preserved, whereas often the feldspars cannot be recognized; at other times the bleached-out feldspar crystals are quite recognizable.

Microscopical examination of the porphyry from numerous places proves it to be fairly uniform in mineral composition. The phenocrysts are quartz and feldspar. Of these the feldspars are much more numerous; the feldspar phenocrysts are partly altered to secondary minerals. These are generally determined to be albite. The groundmass consists of quartz, feldspar, carbonate, sericite, chlorite and pyrite.

A porphyry from the south half of lot 4 in the first concession of Tisdale, examined in thin section, shows the phenocrysts to be largely plagioclase feldspar, while quartz in rounded grains is also present. The groundmass is made up principally of plagioclase feldspar and quartz. Laths of tourmaline are scattered through the rock.

Quartz-porphyry outcrops frequently in the southwest part of Whitney and can be traced by numerous exposures south-westerly across Deloro township. There is also one large area of quartz-porphyry just east of Goose lake in Shaw township.

The porphyry exposed in Whitney and Shaw is very greatly intermingled with grey and green schists and in places it is impossible to separate them, consequently some of the areas marked as porphyry will contain small areas of the schists.

Important gold deposits have been found near the contacts of the quartz-porphyry and other rocks in Tisdale township, but the contacts of the porphyry and other rocks throughout Whitney and Deloro have not shown ore deposits, although such may be found. It would appear that the intrusions of quartz-porphyry at different parts of Tisdale have in some way influenced the deposition or location of the gold, but it is not likely that the porphyry has been the source of the gold-bearing solutions. The porphyry has been subjected to extreme alteration in the zone of vein formation, and has been greatly contorted before the formation of the quartz deposits, which frequently occur in the porphyry as veins or replacements.

Serpentine

Serpentine occurs in parts of the area in large volume. The range of hills immediately southeast of Porcupine lake is composed largely of this rock, which is impregnated with much carbonate. Occasionally veinlets of asbestos are seen. A section of a sample of serpentine rock from the southeast shore of Porcupine lake is made up largely of fibrous serpentine together with residual iron oxides, which in arrangement suggest former crystals of olivine; the remainder of the rock is dolomite. Serpentine rock carrying veinlets of asbestos occurs in Deloro township on H.R. 968. Some of the serpentine is plentifully seamed with narrow veinlets of asbestos of good grade, and if the mineral-carrying serpentine is in quantity, it might be worthy of investigation as a source of asbestos. A similar vein occurs in the southeast part of Eldorado township. Serpentine occurs one-half mile south of Porcupine lake on the boundary between Whitney and Tisdale. A microscopic examination of this serpentine shows the following

minerals: The groundmass is composed of serpentine which represents about 60% of the rock. The balance of the rock is composed of masses of carbonate and disseminated magnetite.

The serpentine is probably of several ages, but it is believed that most of it is younger than the quartz porphyry and older than the granite-porphyry. Narrow dikes of granite-porphyry intrude the ridge of serpentine in lot 11, concession 11, Whitney. Through the areas of volcanic rocks of the Keewatin there are masses of serpentine which are evidently alterations from the older rocks, and therefore much earlier in age than the large areas of serpentine shown on the map.

Serpentine with veinlets of asbestos, south part of Deloro township

Granites, Gneisses

A number of acid rocks, granites and porphyry, were described under the head of the Laurentian in former reports on this area. The term "Laurentian" was used in the broad sense of including granitic rocks the exact age of which was not known, that is, they were known to be younger than the Keewatin, but the relation to the Timiskaming series was not known. These rocks, which occur to the south of Porcupine in Eldorado, Fripp and adjacent townships, are quite fresh, show little gneissic structure, and are believed to be of Algoman age, whereas the gneisses and gneissoid granites which occur about fifty miles to the north of Porcupine may likely be of Laurentian age. These last mentioned rocks are very like those which occur in the broad Laurentian area around lake Nipissing.

It seems advisable to include the granites and granite-porphyry rocks of the Porcupine area with the post-Timiskaming intrusives, particularly since they occur in areas where the Timiskaming series has been largely altered to schist; whereas the igneous rocks just mentioned are particularly fresh-looking.

A few outcrops of granite (granite-porphyry) occur in the township of Whitney. This rock is a medium-grained biotite variety and is not typical of that occurring in large volume to the south. Granite occurs on the Mattagami river south of Wawaitin portage, which is southwest of Porcupine. There are also outcrops of this rock along the south boundaries of Price and Adams where it intrudes Keewatin greenstone. The granites are largely of a flesh-coloured hornblende-biotite variety. Occasionally there is a tendency toward a gneissoid structure in the paralleling of the constituent minerals. Some of the granite is porphyritic with phenocrysts of pink orthoclase up to two inches in length. A striking hornblende granite with crystals of pink feldspar occurs along the south boundary of Blackstock township. It is similar to granite found in McArthur and Fripp townships. In thin section the feldspars are the prominent constituents, being orthoclase, microcline and acid plagioclase. The ferro-magnesian constituents, hornblende and biotite, are largely altered to chlorite and calcite. The quartz is in small grains, apatite and sphene being abundant as accessory minerals. A reddish variety from the east boundary of Fripp township is a hornblende granite showing in thin section quartz, albite, hornblende, apatite and titanite. The hornblende is partly altered to chlorite.

An unusual grey biotite granite is found in the township of Denton about thirty miles southwest of Porcupine. It intrudes Keewatin greenstone, grey schists, and felsite. Gold-bearing veins have been found in both the Keewatin and this grey granite. The occurrence suggests the formation of quartz veins following the intrusion of the granite. The reddish hornblende granite in the same township was not observed in contact with the grey granite.

A number of acid dikes or small stocks which may be called post-Timiskaming intrusives, occur in different parts of the area.

A granite-porphyry has been found in Bristol township. This rock is reddish in colour and consists largely of quartz and feldspar. Zonal structure is well shown in the porphyritic feldspars of which the nuclei are often prisms of feldspar. Microcline and quartz are abundant. The rock contains veinlets of quartz which are frequently auriferous. They have probably been formed on the cooling of the rock.

A red dike rock from the Pettipher claim in Thomas township to the south of Night Hawk lake is essentially quartz and albite and a micrographic intergrowth of these minerals. Another red dike which is quite fine-grained occurs on a small island just south of Gold island in Night Hawk lake. This rock is composed almost wholly of albite. Calcite is scattered through the rock in minute rhombs, and there are numerous cubes of iron pyrites. Occasionally small phenocrysts of albite are seen in the rock, but on the whole it is felsitic in texture.

This rock is also intersected with quartz veinlets which are auriferous.

Dikes of feldspar (albite) porphyry intrude the Keewatin rocks in parts of Deloro township. One such dike occurs on mining claim H.R. 1043 and has been prospected for gold. Gold was found in minute stringers of quartz which intersected the dike. Under the microscope the rock is distinctly a porphyry with phenocrysts of albite in a groundmass of fine feldspar and quartz. Beyond a little sericite and calcite the rock is well preserved. The feldspar-porphyry is similar to that of the Kirkland Lake area, which is later than the Timiskaming series.

The freshness of these dike rocks, as compared with other rocks in the area, is very noticeable. The occurrence of gold-bearing quartz veinlets in them is also marked. Their possible connection with the mineralization of the gold deposits is worthy of consideration.

The chemical composition of these acid dikes is given in the following table:—

—	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Silica	65.42	69.28	59.42
Alumina	15.80	15.53	17.86
Ferric oxide	2.75	2.88	3.46
Ferrous oxide	0.91	0.69	1.59
Lime	1.33	2.15	2.61
Magnesia	0.53	0.93	1.15
Potash	6.26	0.25	0.60
Soda	5.18	7.16	9.60
Carbon dioxide			2.01
Water	2.46	1.44	0.43
Sulphur			1.66

1. Granite-porphyry dike, Thomson claim, Bristol township.
2. Granophyre, Pettipher claim, Thomas township.
3. Felsite, from small island south of Gold island, Night Hawk lake.

Later Intrusives (Keweenawan)

In all parts of the area there are basic dikes which are generally less than 100 feet in width. These rocks are generally quite fresh in texture and are the latest rocks in the area. They are later than the vein formation, since at several places they have been observed cutting distinctly across quartz veins and mineralized schist. In Bristol township, at the McAuley-Brydge claim, a north and south dike 37 feet in width cuts across the gold-bearing schist band which strikes east and west. A very fresh quartz diabase was encountered in the diamond-drilling at the Dome Extension. It is made up of laths of labradorite and augite as the chief constituents. In subordinate amonnts are interstitial quartz, magnetite and pyrite. A similar dike cuts the schistose ore-bearing formation at the Dome mine, showing on the surface in the ravine to the west of the large open pit. It has been traced on the surface for nearly a mile.

A diabase dike which has been greatly altered was cut in driving on the 300-foot level of the Jupiter. The ore body was encountered on each side of the dike.

Dikes of coarse olivine diabase outcrop along the road which leads south from South Porcupine along the boundary between Tisdale and Whitney, and in other localities. These dikes are frequently recognized by the reddish brown sand to which they break down on weathering. The rock consists mainly of plagioclase, augite and olivine. The augite has a light purplish colour due to the presence of titanium. Apatite, ilmenite and biotite are present in minor quantity.

Possible Relation of Quartz Veins to Granite

Granite rocks are not exposed in the main Porcupine gold area, with the exception of some small outcrops throughout Whitney township. However, granites and related intrusive rocks occur prominently in many places around the gold area in which the chief rocks are members of the Keewatin and the Timiskaming. Where these granites occur an intrusive contact with the Keewatin has been observed. Throughout the area there are reddish and greyish dike rocks which may be apophyses of the granites which occur in large volume in the outlying districts. The dike rocks are massive and fairly fresh, and narrow quartz veinlets which are gold-bearing appear to be connected with them. A red granite-porphyry intrudes the Timiskaming and Keewatin in Bristol township. It contains minute veinlets of quartz which sometimes carry gold. A grey biotite granite in Denton township also carries narrow quartz veinlets.

A fine-grained reddish felsitic rock (albite-porphyry) which occurs on some islands in the northeast bay of Night Hawk lake is also intersected by quartz veinlets which are gold-bearing. There is apparently a connection between these rocks and the quartz veins which are likely the filling of tension cracks. In the Kamiskotia Lake area the predominant rock is diabase-gabbro, which is fairly fresh and massive in character. The rock shows considerable differentiation into more acid phases and is also cut by acid dikes which are gold-bearing. The diabase itself probably belongs to the same period of intrusion as the granite rocks, and may be referred tentatively to the post-Timiskaming intrusive series of rocks.

Beck, in his work entitled "The Nature of Ore Deposits," states that "quartz veins more often occur in regions where the older schistose rocks are broken through by granitic, dioritic and diabasic rocks, and are genetically connected with such intrusions." It has been suggested in the notes accompanying the editions of the Porcupine map that the quartz veins of Porcupine are probably the result of a granitic intrusion, the immense quantity of quartz present in the veins having been supplied by the acid magma as a differentiation product. The primary quartz of the veins shows evidence of having been deposited under great pressure, with numerous cavities of gas and liquid inclusions. It has also a marked crystallized structure, with incipient crystal faces showing etched surfaces. The quartz has filled the fissures rapidly, as there is generally an absence of well-defined walls, except where there have been secondary movements. Quartz and rock are often cemented, forming a contact like that of an intrusive.

C. W. Knight noted the occurrence of feldspar in a quartz vein on the Miller-Middleton, one of the Timmins locations, and suggested the relationship of the deposit to granite or pegmatite dikes. The feldspar which is an acid plagioclase has also been noted in other veins, including the No. 1 vein of the Hollinger, the Rea vein, and in many of the narrow veins in the vicinity of Three Nations lake. The feldspar is most abundant near the margins of the veins. The extinction angle of the feldspar in the veins on the Three Nations Lake Mining Company's claim shows it to be very near albite. A chemical analysis of this feldspar gave: Soda, 10.37 per cent.; potash, 0.90 per cent.

The relationship of quartz veins to pegmatite and aplite has been mentioned by several writers. In the Black Hills of South Dakota, C. R. Van Hise noted the gradual transition from intrusive granites through pegmatite dikes and with decreasing quantity of feldspar to quartz veins remote from the granite."

J. E. Spurr, in "The Geology of the Yukon Gold District, Alaska," referring to a set of younger quartz veins on Fortymile creek, says: "They often contain a little feldspar and sometimes, by increase in amount of this mineral, pass into a variety of fine pegmatite. This in turn seems to be transitional into a coarse aplite which is very abundant."[18]

De Launay in his work "The World's Gold," refers to the relation of the gold to the granitic rocks. "At Berezovsk in the Urals in certain veins of microgranite, which themselves cut talcose schists, there are numerous very thin veins of auriferous quartz, containing various sulphides of copper, lead and bismuth, with gold, chromium, and tourmaline, and the granitic mass from which the microgranites are derived appears itself to be auriferous."

In support of the theory of the relation of the quartz veins of Porcupine to igneous intrusions, may be mentioned the following:

1. The irregular occurrence of the quartz in many of the deposits, in lenticular masses, resembling pegmatite dikes.

2. The occurrence of feldspar, scheelite and tourmaline in the quartz in several deposits.

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[17] U. S. Geological Survey, 16th Annual Report, Principles of North American Pre-Cambrian Geology.

[18] U. S. Geological Survey, 1896.

3. The great pressure at which the quartz has been deposited, indicated by the presence of liquid inclusions and gas bubbles. These are frequently seen in quartz in granites.

4. The frozen contacts of quartz and enclosing country rock. The free walls seen at some properties indicate a secondary movement in the quartz, since these walls are slickensided. Where free walls exist they may be either the hanging or foot wall, while the other wall is indistinct—grading into the country rock.

5. The occurrence of porphyritic dikes, frequently cut by minute veinlets of quartz, which represent the final solidification of the porphyry magma, and which frequently carry gold values, as on Night Hawk lake.

Other Vein Minerals

Scheelite, a tungstate of calcium, occurs in some of the veins around Pearl lake. It appears to be associated with the early quartz of the veins. It has been often broken up and cemented by later quartz or calcite. The largest samples of the mineral have been obtained from the Jupiter mine, sometimes in masses several inches across. It occurs also in the Hollinger, McIntyre and Plenaurum, but only in minor quantity. The quantity of this valuable mineral in proportion to the vein is quite insignificant, and no attempt is made to save it. It is interesting to note that scheelite usually occurs with minerals like topaz, cassiterite, tourmaline and arsenopyrite in pegmatitic veins, which are considered to have a genetic relationship with granite. Its presence in these veins may point to a pegmatitic origin for the veins and a high temperature for the formation of the primary constituents of the veins.

Tourmaline occurs in some of the quartz veins. In some of the ore from the shaft at the Dome Extension it has been found in irregular fine needles along with pyrrhotite in gold-bearing quartz. Many of the narrow veins on the Dome Extension ridge contain tourmaline with the quartz, some of which is in such fine needles that the quartz has a smoky appearance. It is also noted at other properties, such as the West Dome, Vipond and Jupiter. In these occurrences it is present as one of the early constituents with the primary quartz of the veins. This mineral does not, however, appear to be present to any extent in the larger productive veins of the Pearl Lake area. The mineral has been found in the veins which are in the basaltic rock throughout the northeast part of Tisdale and the northwest part of Whitney. Here it is of secondary occurrence, occurring with calcite in the fractures which have been formed in the primary quartz.

Temperature of Formation of Deposits

Lindgren, in his work "Mineral Deposits,"[19] classifies the gold-bearing veins of Ontario with those deposits which are formed at high temperatures. He states, however, that certain characteristics of the veins resemble those of California which he classifies with the deposits formed at intermediate temperatures. It is probable that the deposits of Porcupine have been formed at various temperatures. For example, some of the veins in which tourmaline and pyrrhotite occur may be grouped with high-temperature deposits. Such veins have been noted on the Dome Extension and in the north part of Tisdale; whereas many of the large deposits do not appear to carry these or other minerals such as are found at high temperatures. The writer has not observed these minerals in the main ore bodies at the Hollinger mine. The quartz varies considerably, sometimes being glassy and semitransparent and containing visible gold, and then again, as is usual in the best ore bodies, of a milky white character and rather coarsely crystalline. The alteration of the wall rocks has usually been accompanied by the formation of sericite, and carbonates of various composition.

[19] Mineral Deposits, p. 638.

Character of the Gold-Bearing Deposits

All the gold deposits at Porcupine are believed to belong to the same period of ore deposition. They occur in rocks of Keewatin, Timiskaming, pre-Algoman and Algoman age while the mineralization was probably in Algoman times. Some writers on this area have attempted to make a classification based on structural resemblance in certain of the deposits. It may be said that each deposit has peculiarities of its own, but that in general thero are characteristics common to all. For example, all the deposits will in parts show such structures as simple vein, lode, irregular masses of quartz, and mineralized schist. These structures are largely dependent on the character of the enclosing rock, whether schistose, greatly foliated, or massive. Some deposits have been formed near the contact of the quartz-porphyry with other rocks, but this feature is not sufficient in itself to warrant such deposits along contacts being classified separately. For example, at the Dome mine the deposit exposed in the large open pit is considerably north of the contact and in the conglomerate and slate, whereas a deposit

Narrow quartz vein in Keewatin carbonate schist at Dome property. Nov., 1910.

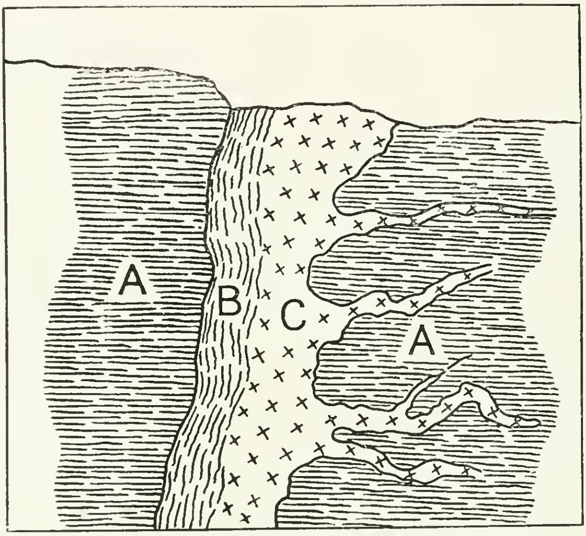
underground to the south of No. 2 shaft and only a few hundred feet away has the quartz-porphyry as the hanging wall.

While a certain amount of fissuring was present at the beginning of the ore deposition, it is believed that the deposits formed at that time were enlarged by metasomatic replacement. Evidence of replacement of the wall rock can be seen at many of the mines and is particularly well shown at the Dome Lake mine.

It is even possible, as expressed by L. C. Gratton [19a], in his description of the veins of the southern Appalachians, that the vein-forming solutions representing the final products of emanation of a granite magma were injected under heavy pressure into the surrounding rocks along lines of weakness, and so like pegmatite dikes made a space for themselves by opening their own fissures. Such a mode of formation could easily explain the very irregular forms assumed by some of the quartz masses.

[19a] Bull. No. 293, U.S.G.S., 1906, p. 59.

The irregular fissuring has produced a great variety of quartz structures, varying from the tabular, though often irregular or lenticular, vein which may be traced several hundred feet, to mere veinlets, often only a fraction of an inch in width and a few feet in length, which ramify through a rock that has been subjected to small irregular fissuring. This latter variety is well illustrated in the fissuring of ankerite bands, so characteristic of some of the gold deposits of Porcupine. Irregular and lenticular bodies of quartz often occur which may have a width of ten or twenty feet, but which die away in a distance of fifty feet. Again, there are dome-like masses of quartz which are elliptical or oval in surface outline. In some parts at least these masses can be seen in contact with underlying rocks at a low angle, which would suggest that they are broad lenticular masses which have filled lateral fissures in the country rock. The most conspicuous dome masses were those of the Dome property, where the two largest were about 125 feet by 100 feet. A fissure may be vertical and irregular at some points. At others it may incline at a lower angle to the horizontal or take on a more or less lenticular form.



Ideal section of vein showing veinlets extending into wall rock. This structure is frequent in the north part of Tisdale. The above sketch somewhat resembles the main vein at the Rea mine as shown near the surface

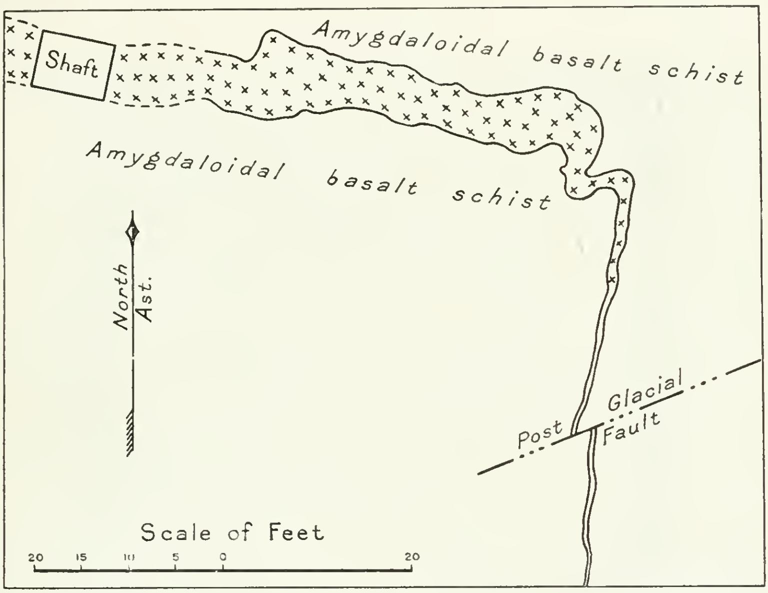
(A) Altered greenstone impregnated with carbonate
(B) Well defined hanging wall and adjacent disturbed portion of vein with tourmaline streaks and greatest gold values
(C) Undisturbed part of vein showing little or no values

The term "vein" as used in this report is not confined to the filling of a single fissure with well-defined walls, for this type of vein is rather the exception in the Porcupine area. The fissuring has been so irregular that a "vein" in one part may consist largely of quartz, and in another part of numerous veinlets of quartz and intervening schist, greatly resembling a stockwork; again, the main part of a vein may be almost vertical in attitude, but many veinlets, as branches from the main vein, may extend laterally into the country rock. It is often found that the values are obtained in parts of tho vertical vein which have been subjected to a later movement and enrichment, whereas the lateral veins have little or no value. This is illustrated in the No. 1 vein at the Rea mine.

The relationship of the strike of the veins to that of the enclosing rock is often difficult to determine, since generally along the veins there has been shearing of the country rock which may conform to the general direction of the strike of the veins. However, by determining numerous strikes in the schist away from the veins, it is

seen that the majority of them are inclined to the strike of the enclosing rocks. In dip the veins vary from vertical to nearly horizontal. In No. 1 shaft of the Hollinger the vein is practically vertical, while a series of narrow quartz veins, 6 to 18 inches wide on the Lindburg claim, have a dip at the surface of only 20°. The prevailing dip of the schist in the Porcupine area is to the north at a high angle, and frequently the veins dip distinctly to the south across the cleavage of the schist. While it is apparent that most of the deformation of the country antedates the vein formation, nevertheless there is a decided tendency in many cases for the fissuring to be influenced by the direction of schistosity, which is also a direction of weakness; hence we find veins having a more or less lenticular structure, the strike of which closely corresponds to that of the country rock.

It will generally be found that where the lenses are broad the schistose wall rock is approximately parallel with the lens; whereas the narrow portions of vein between lenses frequently cut across the schist.



Surface plan of part of the "blue" quartz vein on the Millerton property showing its irregular and lenticular character. Abundant large albite crystals occur in the quartz vein. The vein has been displaced by a post-glacial fault, the glaciated surface to the north being one foot higher than that to the south of the fault

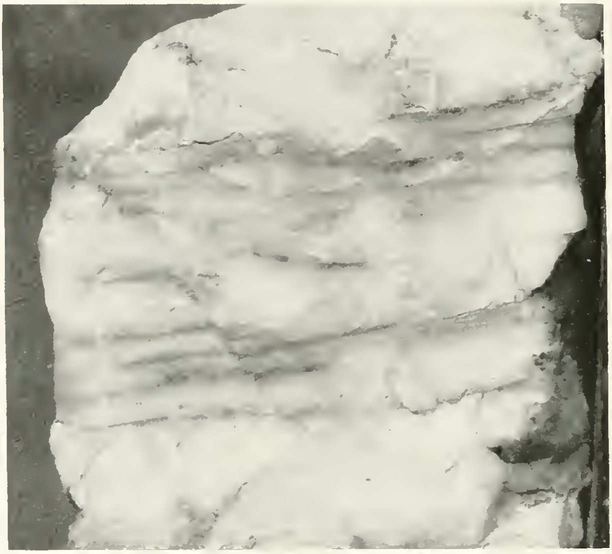
Lenticular veins occur chiefly where the country rocks have been intensely sheared or rendered schistose, as around Pearl lake. Usually when there has been less disturbance the veins are more likely to have a marked difference in strike from the enclosing rock—as around Three Nations lake and the porphyry area south of Simpson lake. It may be stated that the larger and usually lenticular veins of the area occur where the rocks are extremely schistose, while the narrower, better defined veins occur as stringers from these main lenticular veins, or in less disturbed areas.

The quartz-porphyry on the Preston, Fogg (L.O. 325) and other claims in Deloro township along its north boundary is more massive than that near the Dome or around Pearl lake, while the greenstone is also much less altered to schist than in other parts. Consequently the veins are narrower and have not the lenticular structure so characteristic of those deposits at Porcupine which are in schistose rocks. Most of these veins have a strike nearly north and south across the mass of quartz-porphyry. They lack the banded structure so frequently seen in the Pearl Lake area. Coarse gold associated with zincblende and pyrite occurs in some of the narrow veins, many

of which are only a few inches in width. Owing to the narrowness of these rich veins, and the massive character of the porphyry rock which shows little impregnation with gold-bearing solutions, difficulty has been experienced in finding ore bodies of commercial importance.

Distribution of Veins

While gold-bearing veins occur over a wide area and are often isolated, it is seen, from a number of those already discovered, that they occur in groups along certain lines. For instance, in Tisdale township there are at least three distinct areas where the fissuring has been most pronounced. One such area extends from the southeast end of Miller lake, on lot 11, in the second concession, in a northeasterly direction for three miles, and includes such veins as the Porcupine Crown, Millerton, Hollinger, Acme, McIntyre, Jupiter, Rea, and in addition others with visible gold. The average strike of the veins here is northeast and southwest. An exception is a vein on the Porcupine Crown, which strikes north and south.



Streaked ore from the Jupiter mine. The dark lines are tourmaline, while the intervening quartz is greatly crushed and shows visible gold

Another series, including the Smith, Davidson, Crown Chartered and Dobie, occurs in the northeast part of the township. To these should be added the Scottish Ontario, Mullholland, Hughes and Gold Reef, which are in the northwest part of Whitney township. The general direction of these veins is east and west.

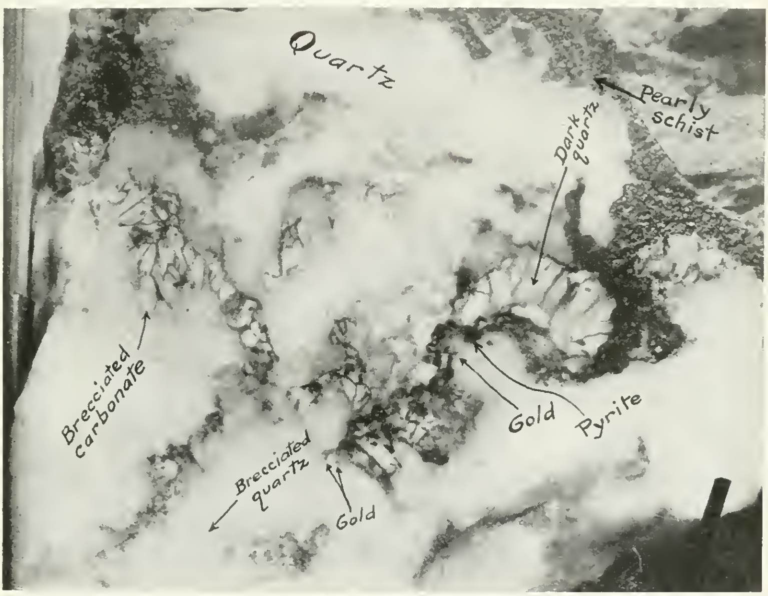
Again, in the southeast part of the township is a group including the Dome Lake, West Dome, Dome, and Dome Extension, with a general strike north of east.

Occurrence of the Gold

A field examination shows that there is an irregular distribution of the gold in the quartz veins. Very often it occurs along dark streaks in the quartz, along the contacts of quartz and schist, or around patches of dark coloured mineral in the quartz. At the surface, rich portions of veins are often indicated by rusty streaks or patches, while at depth the rusty character gives place to dark grey, black or greenish colours.

Under the microscope the gold is generally found in areas which have been greatly crushed or in the quartz or schist bordering on these areas.

The prominent minerals which occur in the crushed areas are pyrite, calcite, dolomite, sericite, chlorite, tourmaline and quartz. It is thought that most of the gold has been deposited along with pyrite from the impure solutions which circulated in the minute fissures and crushed areas of the primary quartz of the veins. The quartz of No. 1 vein of the Hollinger mine shows numerous dark streaks in parts of it and often across the width of the vein. These are generally short and irregular in distribution. Iron pyrites and often galena occur with the gold. Microscopically, the quartz occurs in fairly large grains, contains liquid and gas inclusions, and has been subjected to secondary pressure and granulation along the margins of the grains. The iron pyrites often occurs in well-shaped crystals which have been formed subsequent to the crushing. These fine dark streaks may have resulted from a solidification and shrinkage of the quartz forming filmy cracks, which may have become slip or crushing planes along which the richer gold-bearing solutions were deposited at a later period. These minute dark streaks in the quartz are frequently slickensided, and this character may often be seen in hand specimens, as from Rea or Vipond mines.



Brecciated structure of quartz from McIntyre main vein (natural size)

It should be noted that where cracks or fracture planes have been produced in a quartz vein and subsequently filled by minerals from solution, secondary quartz can be distinguished with difficulty, if at all, from the original quartz. Hence it is not always possible to say whether visible gold in such a vein occurs in the original or in secondary quartz.

Often a vein may show a width of ten feet but the fractured portion may be only a few feet, or even inches, wide along either wall. In this portion there may be many streaks of dark mineral which are often parallel, giving a banded character to the ore, as in many of the veins in the north part of Whitney and Tisdale, namely, at the Mullholland, Scottish Ontario, Davidson and adjoining properties. A similar banded structure is seen at the Rea mine. At these properties tourmaline is the principal mineral of the streaks. The gold may occur along these lines or in the intervening quartz, which is often much crushed and filled with later minerals. Several sections were examined, which showed grains of gold apparently enclosed in the primary quartz, but the occurrence is much less prominent than where gold occurs in the crushed areas.

It is important to note that practically all the veins which are gold-bearing contain considerable carbonate of varied composition. Wherever the enclosing rocks are schistose they always carry carbonate and frequently effervesce with cold hydrochloric acid. Much of the carbonate of the veins has been absorbed from the wall rock, while portions have been formed from ascending solutions which circulated in the veins. Pyrite and grains of gold frequently occur in the carbonate.

Carbonate in the form of ankerite constitutes the main portion of veins at the West Dome, Apex, and in parts of Deloro township. This carbonate is distinctly earlier than the quartz veinlets which intersect the ankerite veins. Both the ankerite and quartz have been fractured and veinlets of later carbonate deposited in them.

Thin Sections of Vein Quartz

In drawing No. 1 of a section of Hollinger ore the fracturing of the original quartz is evident, while veinlets of calcite penetrate the quartz. Grains of a dark mineral, galena (?), are arranged in a linear manner in the calcite and quartz, and a few grains of gold occur in the calcite or along the contact of quartz grains and calcite.

In drawing No. 2 of a section of Dome ore there is very little dark mineral. The crushed zones are quite clearly shown. Some of the larger grains of quartz have a dusted appearance, while some of the finer grains are quite clear and may be a later quartz. In the crushed areas are grains and strings of gold, and also crystals of iron pyrites, on some of which gold is deposited.

In drawings Nos. 3 and 4 of sections of quartz from the Hunter claim, Porcupine lake, the quartz is almost all very fine-grained, which condition may have been produced by crushing of larger grains. In No. 3 remnants of plagioclase feldspar remain, and a grain of pyrite shows several gold grains deposited on it.

Drawings Nos. 5 and 6, also, show crushed areas. In No. 6 a grain of gold occurs in a large grain of quartz as though a constituent of the primary quartz.

Sulphides and other Minerals

The following sulphides have been recognized in veins at Porcupine: iron pyrites, copper pyrites, pyrrhotite, arsenical pyrites, galena and zincblende. Of these the most abundant is iron pyrites, which occurs in some quantity in all the gold-bearing veins. Copper pyrites, galena and zincblende, although also widely distributed, occur in minor quantity. Pyrrhotite is the chief sulphide in the veins which are being developed in No. 4 shaft of the Dome Extension. Arsenical pyrites occurs in quantity in the quartz veins at the McAuley-Brydge property in Bristol township.

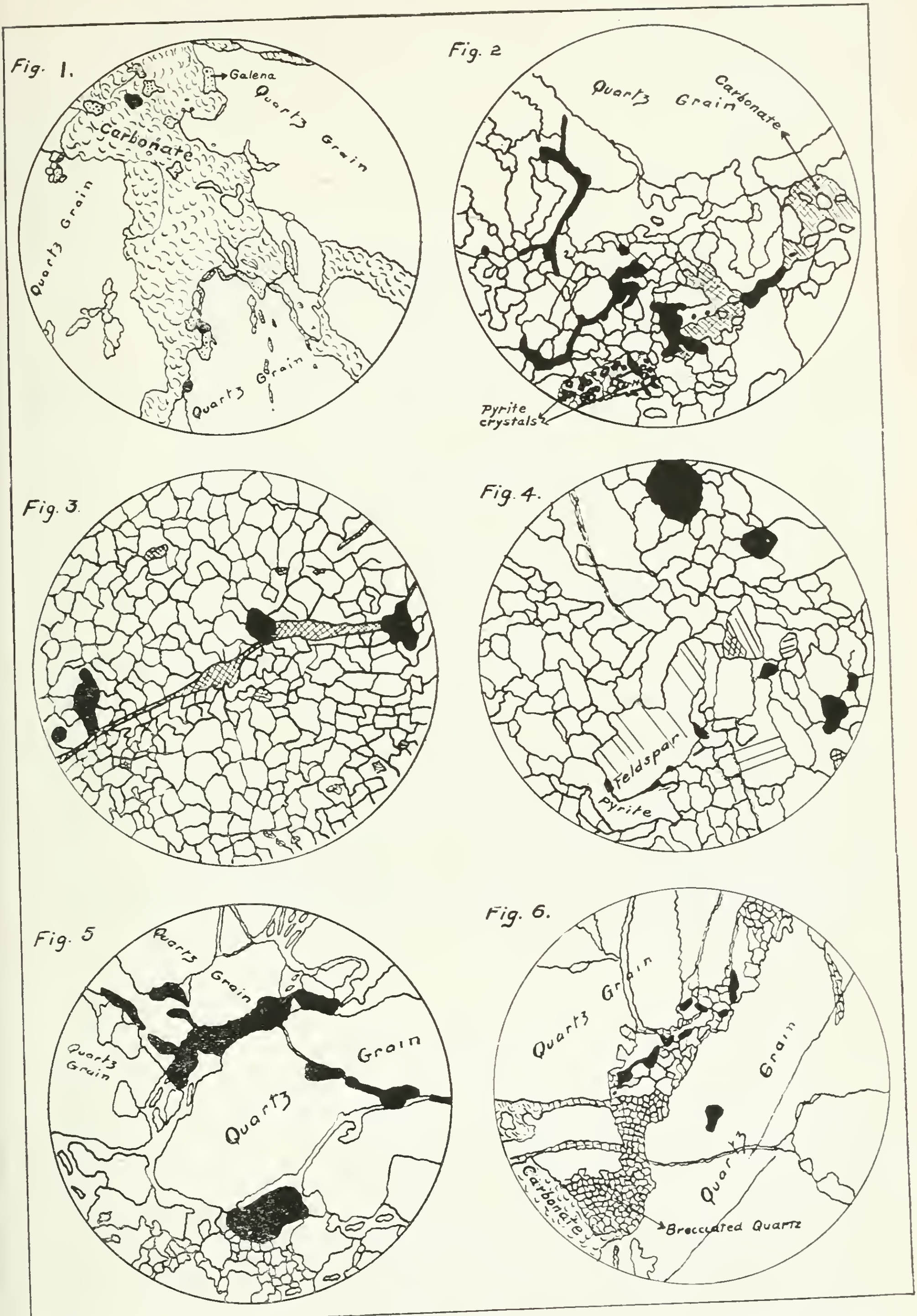
Only one telluride has been recognized, occurring in the quartz-carbonate deposit at the Powell claim, M.E. 20, in Deloro township. A chemical test of the mineral gave the following percentages: silver, 61.88 per cent.; gold, 0.10 per cent., with strong reactions for tellurium, corresponding to the mineral hessite. Native gold occurs as a later constituent in minute seams in the hessite. Robt. Harvie reported the telluride "petzite" in quartz-ankerite deposits at Opasatika lake in the province of Quebec.[20] The presence of telluride in a quartz ore, containing considerable pyrites, from the Mikado mine, lake of the Woods, has lately been recognized in the laboratory of the Provincial Assay Office.

The rare mineral scheelite has been found in small quantities in several properties around Pearl lake. This is the second occurrence noted of this mineral in Ontario, it having been reported on the dump at the Victoria mines, near Sudbury.[21]

Since the whole surface of the area has been deeply eroded during recent glacial periods, there is now little evidence of secondary enrichment. The enrichment is very superficial, extending only from a few inches to a few feet in depth. The outcrops of

[20] Notes on a Discovery of a Telluride Gold Ore at Opasatika, etc., The Journal of the Canadian Mining Institute, Vol. XIV., p. 164.

[21] Report on the Tungsten Ores of Canada. T. L. Walker, Department of Mines, Canada, 1909.



Drawings of thin sections of ore from Porcupine quartz veins. Fig. 1, Hollinger. Fig. 2, Dome. Figs. 3 and 4, Porcupine Lake. Fig. 5, Rea. Fig. 6, Vipond. Black spots are native gold, x 30 diameters.

the veins and wall rocks are usually discoloured or decomposed, due to the oxidation of the iron pyrites and the ferrous carbonate in the ankerite or other iron-bearing carbonates. Cubes of iron pyrites are occasionally obtained at the surface, while copper pyrites and arsenopyrite also occur near the surface. Where the veins have been oxidized to any depth, there are generally some very recent water courses in evidence. Developments so far have shown that, after this very superficial zone has been penetrated, the character of the vein material has remained the same as far as mining operations have continued, namely about 1,000 feet.

No. 4 vein on 425-foot level, Hollinger mine, showing contact of quartz and schist, and inclusions of schist in the quartz

MINING PROPERTIES

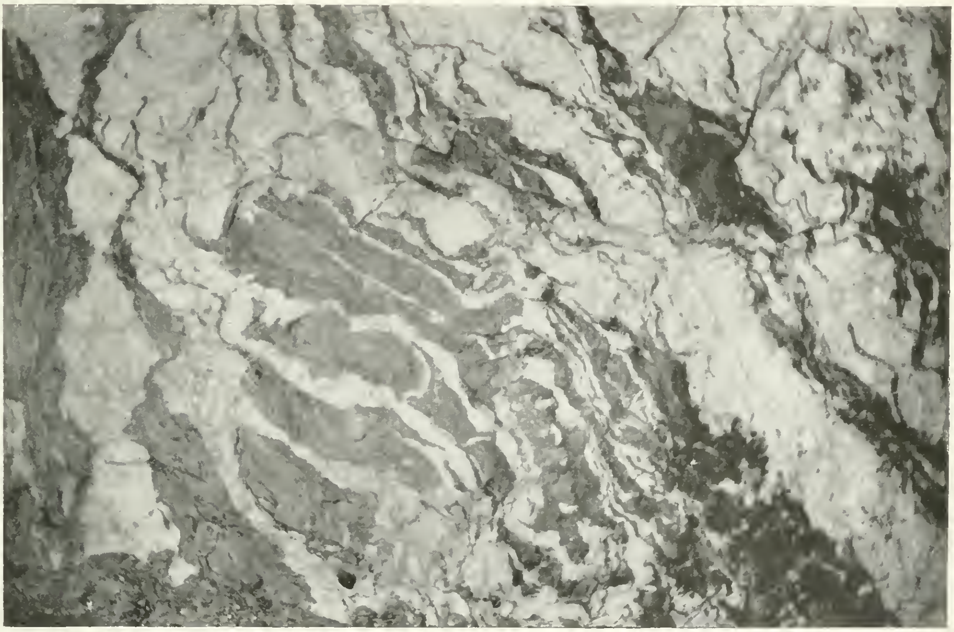
Hollinger

The Hollinger Gold Mines, Limited, is a subsidiary company of the Canadian Mining and Finance Company which also controls the Acme and Millerton mines. Development work has been carried on to a much greater extent on the Hollinger than on the other two properties.

The main workings of the Hollinger are situated about one-half a mile southwest of Pearl lake. The property has been in operation since the winter of 1909-10, following the discovery of gold on the Hollinger claims. The increase in development and production has required constant alterations and additions to the plant. The first mill on the property was a small experimental two-stamp Tremaine mill from which the first bullion in the Porcupine camp was produced. The Hollinger has now a 100 stamp-mill, concentrating and cyanide plant. During July, 1915, 80 stamps were

crushing ore from the Hollinger mine, nearly 1,000 tons being treated daily. The other stamps were crushing ore from the Acme mine.

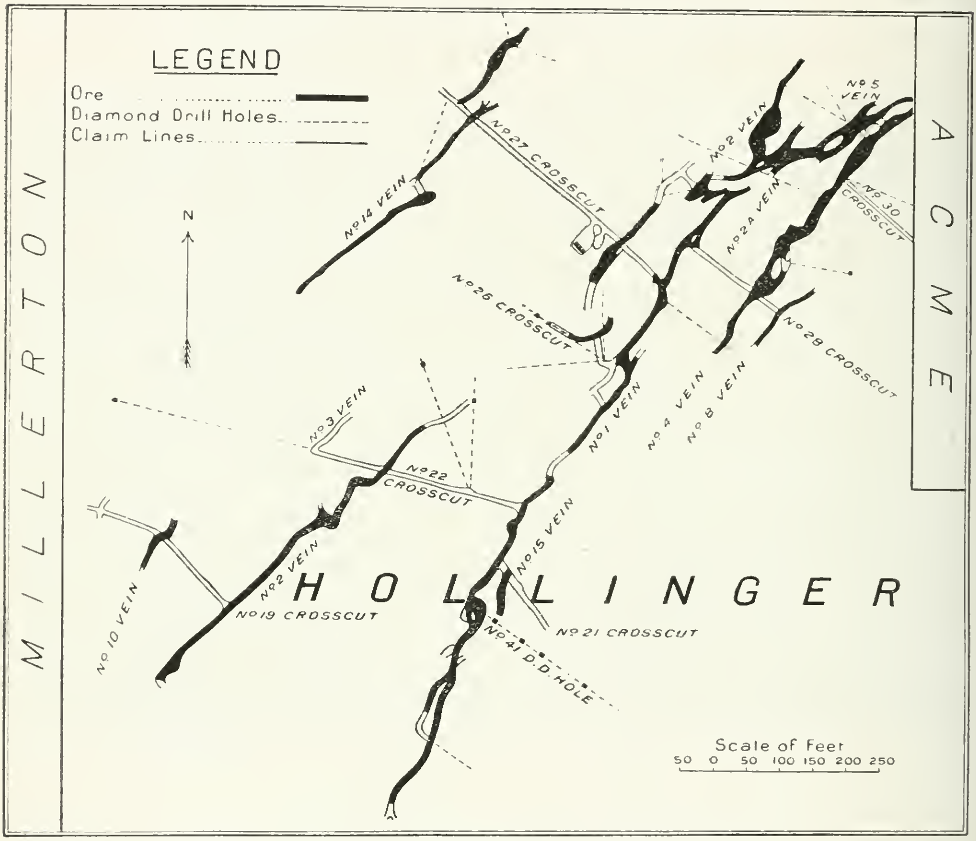
The Hollinger vein system has a northeast and southwest trend. It is composed of a number of lenticular masses of quartz, and quartz and interbanded schist, some of which can hardly be looked upon as true veins but rather as impregnations of the country rock along lines of weakness. The country rock in the vicinity of the veins is usually very much altered by carbonate, sericite, and other secondary minerals, while the most promising conditions are those where the rocks are quite schistose and impregnated with fine-grained pyrite and silica. When the wall rocks are blocky and less altered it has usually been found that the vein is less promising and the vein or lens may not make through the more massive ground. Frequently the ore body is largely quartz and then again an alternation of quartz and schist bands very irregularly distributed. The character of the ore bodies suggests that the rock was in a schistose



Contact of quartz and schist on the N.W. wall of No. 4 vein Hollinger mine, where vein was intersected in the first cross cut from No. 1 vein on the 100-foot level. Width of exposure, 5½ feet

condition when the quartz was introduced along the fractures. The hot siliceous solutions forced their way along lines of weakness in the country rock, filling any open fissures and partly replacing and impregnating the schist. Strips of schist are frequently observed rather parallel with the walls and enclosed in the quartz. Iron pyrites is the prominent sulphide mineral, occurring both in fracture planes in the quartz and in the wall rock. Galena and zincblende occur in minor quantity. The rare tungsten mineral scheelite has been found in small amount in No. 1 vein. The ore bodies vary greatly in width. In some places the stopes are as wide as 40 feet. Development has now extended to the 1,000-foot level on No. 1 vein. This vein is the most important of any known on the property. On the 200-foot level the ore shoot has been proven to be over 1,000 feet in length. This vein consists of a number of lenticular masses widening and thinning along the strike. Frequently in the development it was necessary to cross-cut slightly to the left to pick up the ore shoot. The lenses slightly lap, hence the necessity of cross-cutting to pick up the vein. The ore in No. 2 vein varies considerably from that in No. 1. A great part of No. 2 consists

of grey schistose rock impregnated with silica and iron pyrites, and in hand specimens very little white vein quartz can be recognized in such ore. This structure of ore body is clearly the result of metasomatic replacement along lines of weakness. Fifty-four veins are reported to have been located on the properties while only a few of these (12) have been reached on the underground workings. The most important veins that have been developed are Nos. 1, 2, 4, 8, 16, 37 and 41. An inclined diamond-drill hole was put down to a depth of 2,000 feet, or 1,425 feet vertically. This hole cross-cut the formation and penetrated several mineralized zones which were gold-bearing, indicating that the same condition of rock formation and vein characteristics extended to at least 1,425 feet.



Plan of the 200 foot level, Hollinger Gold Mines, Limited

The following notes relative to the occurrence of the gold at this property have been taken from P. A. Robbins' first annual report.

So far no heavy faulting has been encountered, but there are many sinuous twists and turns in the veins, the veins being practically vertical, as far as developed, showing some tendency to dip to the southeast. The schist is heavily mineralized with iron pyrite and, generally speaking, pyrite is disseminated throughout the quartz masses, being contained in the cleavages, particularly near the walls.

The gold has evidently been deposited contemporaneously with, or a little later than, the pyrite, as occasional instances have been noted where the pyrite is encased in gold.

Generally the occurrence of galena portends rich gold values, and to a lesser degree the occurrence of sphalerite is an indication of gold values.

Large blocky crystals of pyrite are usually attended by low values in gold, while the finely crystalline pyrite occurs with relatively higher gold values.

The schist walls of the main vein do not usually carry payable values, except where contiguous to rich sections of the vein, and in such cases the schist seems to be more or less silicified, pointing to the silica-bearing solutions as having also provided the gold. Generally, the southeast wall is the richer.

In other cases, notably vein No. 2, the schist, where it is interfoliated with small quartz stringers, carries relatively high gold values.

There are evidences of the metasomatic replacement of schist by quartz, the replacement in many instances being incomplete.

In the quartz masses the occurrence of gold is extremely spotty, and check samples taken from the same points on the vein will seldom agree within reasonable limits.

Our sampling has shown that the occurrence of visible gold does not necessarily mean payable values, and, to the contrary, payable values are commonly found where no visible gold has been observed. The quartz where streaked by fine lines of pyrite in the cleavages is generally more consistent in the matter of gold values than the clear masses carrying occasional spectacular showings.

The following information has been obtained from P. A. Robbins' statement in the fourth annual report of the Hollinger mine:—

From 1911 to the end of 1914 the Hollinger mine has produced $6,134,339.56 in gold and silver. The annual report of the mine for 1914 shows that there are ore reserves to the value of $13,358,420, representing 1,162,960 tons of ore with a value of $11.49 per ton. During the year 208,936 tons of ore with value of $13.67 per ton were treated in the mill. The value of the bullion recovered from the treatment was $2,688,354.80, while dividends paid out for the year were $1,170,000. Working costs per ton of ore (exclusive of depreciation) were $4.42.

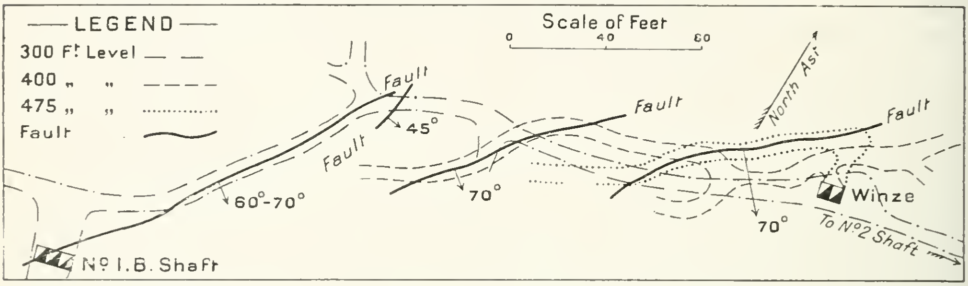
The Canadian Mining and Finance Company has constructed a central air-compressing and water-pumping plant on the south shore of Gillies lake. The building is of reinforced concrete and steel, being absolutely fireproof. Three compressors, having a capacity of 4,500 cubic feet of free air per minute, have been installed. One compressor, a Fraser and Chalmers machine, is of special design, being constructed with valves which automatically adjust the output of the machine to the exact requirements of the demand for air, thus doing away with peak loads and thereby reducing the cost of power, which is purchased on a basic of peak loads. The other two compressors are of Nordberg type which possess the advantage of being reversible, that is, they may be operated as steam engines and their motors may be used for generating electric power. In case of shortage of supply of electricity from the hydro-electric plants on the Mattagami river, power can be supplied for these compressors by a boiler plant installed in the same building.

The Canadian Mining and Finance Company is also sinking a central shaft to be connected with the different properties. The shaft will be a six-compartment one, with stations at 425, 800, 1,250 and deeper levels as the development may require. From each station cross-cuts will be driven to tap the various ore bodies on the different properties. Electric locomotives operating in the cross-cuts will collect the ore from each property and deliver it to the central shaft. The ore will be given a preliminary crushing before being hoisted to the surface. Two shaft compartments will be utilized for hoisting ore, two for handling men and supplies, one for carrying on developments at levels below the working level, and one for ladderway, pipes and electric conductors.

Jupiter

This property is situated on the north shore of Pearl lake. The veins occur in a belt of quite schistose rocks which are largely altered volcanics. Here and there in the mine there are bands of schistose quartz-porphyry. The veins cut all these rocks, but the best values are found where the veins are in the altered volcanics. To the north

of the workings there is a ridge of less altered greenstone. The rocks bearing the veins are impregnated with carbonate. The veins are lenticular in structure and often consist of interbanded quartz and schist. There is frequently a streaked character to the ore, that is, fine lines of dark mineral occur in the quartz parallel to the walls, indicating a later fracturing or inclusion of strips of schist in the quartz. Values do not extend into the wall rock except contiguous to the veins, but when the interbanding occurs, good values are frequently obtained in the included schist. Development has



Plan of part of the underground workings of the Jupiter mine, showing location of a prominent fault on there different levels. The drifts are on the veins except where shown along the fault plane.

proceeded to the 475-foot level where the ore body has been drifted on. A prominent fault having a northeast and southwest strike and dip of about 70° to the southeast has been encountered on the different levels. This fault has displaced the vein, and the development has been complicated by minor faults. On the 475-foot level, where the fault approximated the strike of the vein for some distance, the ore body was first encountered below the fault. By drifting on the fault plane to the southwest, the vein above the fault was encountered; drag ore was found along the fault plane. In the east drift on the 400-foot level there is considerable scheelite in the vein, but this is not of economic importance.

Vipond

This property, which is situated about three-quarters of a mile south of Pearl lake, was one of the earliest on which gold-bearing veins were discovered. The rock enclosing the veins is of a basic character and frequently shows amygdules. It is somewhat schistose but more massive than the rock to the southwest of Pearl lake. Characteristic torsion cracks, so often seen in Keewatin greenstone, occur frequently. The vein system has a general northeast and southwest strike, while the lenses of quartz or quartz and schist vary considerably in width from point to point. Ore shoots have

Photo by A. Tomkinson

General View of Porcupine Vipond gold mine.

been developed on what was considered two different veins known as the "Godfrey" and the "Davidson." Recent work has tended to show that these veins are very likely parts of the same vein which have been displaced by faulting. Blocks of ore have been taken from the workings between the Godfrey and Davidson veins. This material represents portions of ore which have been crushed along the fault zone. The fault is not marked by a clean-cut gouge plane. There has been faulting in the vein known as the Davidson, but lateral development has in some cases picked up the continuation of the ore shoot. The location of the displaced ore bodies is being facilitated by diamond-drilling of lateral holes. Ore shoots have been developed to the third level, and a winze is being sunk to the 400-foot level. About 125 tons of ore are being treated daily by cyanidation in the mill, where the ore is reduced in Hardinge ball and tube mills.

C. H. Poirier, manager of the mine, estimates the ore reserves on 31st March, 1915, at 48,300 tons, worth approximately $430,000. During the first six months of 1915

Quartz vein on 100-foot level, Porcupine Crown mine. The dark spots are drill holes

the Vipond produced $134,000 worth of gold, showing profits of $53,000. The assay value of the ore sent to the mill was $10.27, while an extraction of 91.6% was obtained. Costs have been reduced to $5.00 per ton. Later development has shown the winze completed to the 400-foot level and partly extended to the 500-foot level. This development has shown the continuation of ore of excellent grade which has added greatly to the ore reserves.

Schumacher

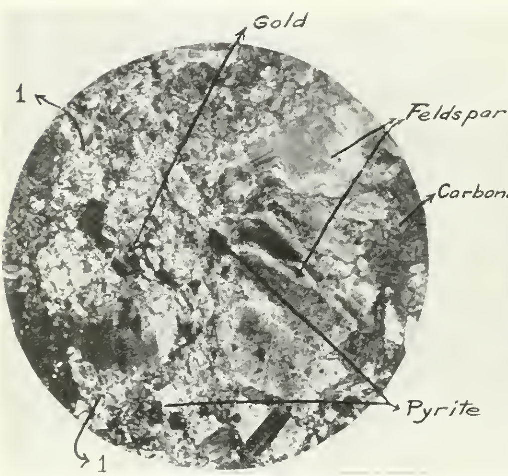
This property is on the south shore of Pearl lake, and consists of a veteran claim of about 160 acres. It lies to the east of the McIntyre and Acme properties. The occurrence of the ore shoots is similar to that on the adjacent properties, the ore consisting of quartz and irregularly interbanded schist, or schist heavily impregnated with iron pyrites. The best ore usually has a streaked character. The veins are very tortuous in their strike while the enclosing schist is often quite foliated. The rocks on the whole belong to the altered volcanic series. In the workings north of the shaft on the 100-foot level there is an interbanded light and dark fine-grained rock which looks

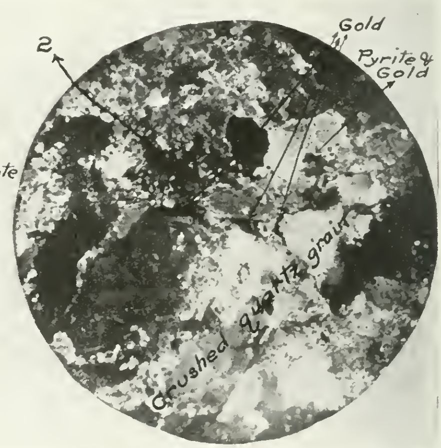
like an altered sediment. Schistose quartz-porphyry occurs on the north part of the property. A prominent fault has been encountered on the first level north of the shaft. It dips to the south and shows near the shaft on the 300-foot level. The fault has the characteristics of a thrust from the southwest, since the fault plane shows the corrugations or grooves in that plane while the schist on the foot wall of the fault is bent up the plane of the fault. Development is proceeding to deeper levels to prospect below the fault plane and also the area towards the north part which is near the contact with the quartz-porphyry.

A mill with a cyanide plant is at present being installed to treat from 100 to 120 tons per day, and the treatment will be very similar to that at the McIntyre mill, which has proved so very satisfactory.

Porcupine Crown

The Porcupine Crown mine, formerly known as the McEnaney claim, lies to the south of the Hollinger mine. The first development was on a vein with a northeast and southwest strike, which dipped from the shaft at 50 feet. Drifting and cross-cutting

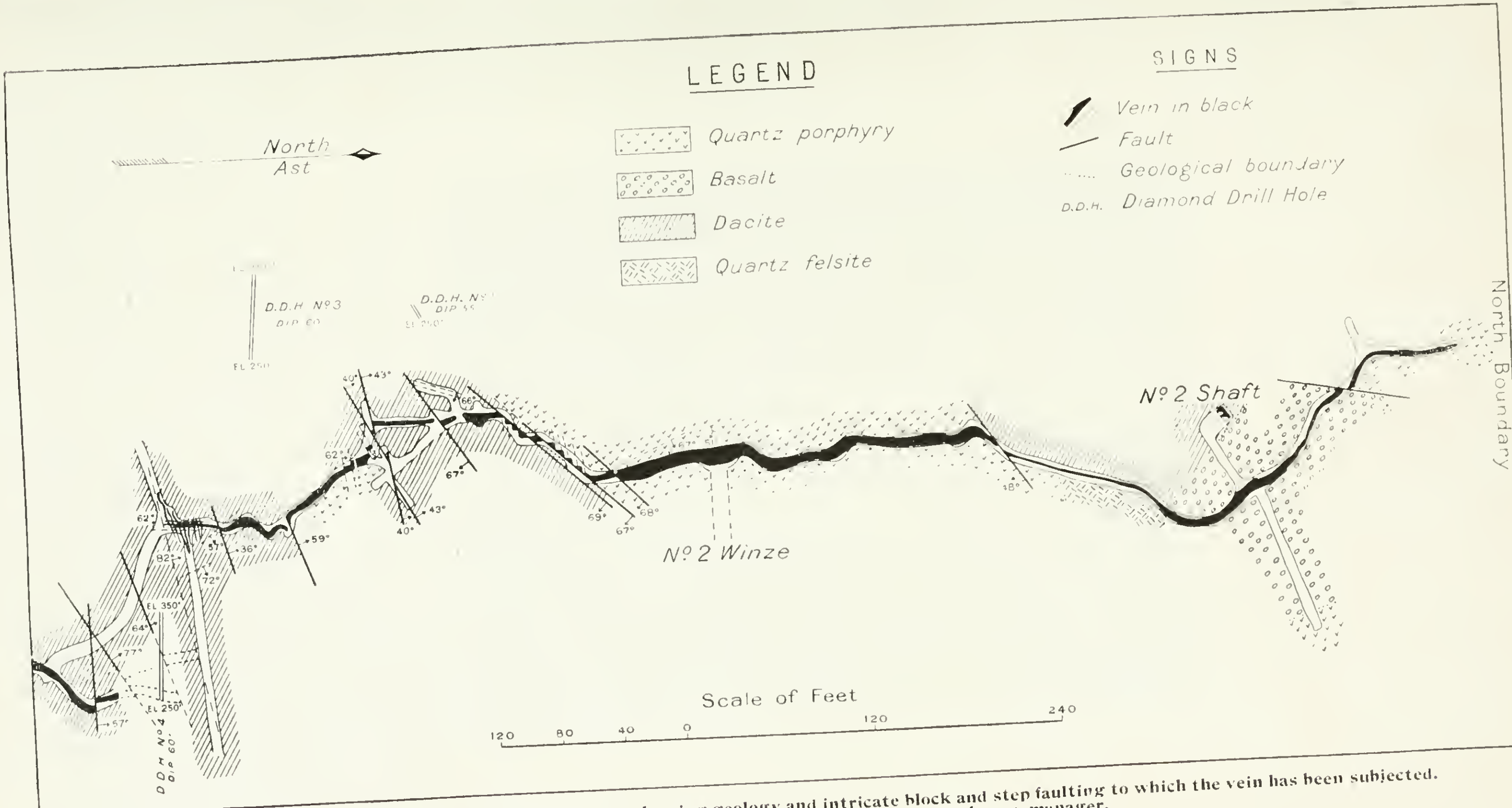




Photomicrograph, Porcupine Crown **Photomicrograph, Vipond**

1. Fine grained carbonate, tourmaline, quartz, feldspar, and sericite
2. Brecciated quartz with later carbonate.

on the 100-foot level failed to locate this vein. However, diamond-drilling was resorted to on the 100-foot level, which resulted in the finding of a new vein only a few feet from one of the workings on the 100-foot level. This vein had a strike where first encountered of northwest and southeast and contained high values in gold. The important development on the property has since been on this vein, which has been followed to the 500-foot level, and on five levels stopes have been opened up along the ore shoot. To the south of the shaft the general strike of the vein is about north and south, while the dip is to the east. The vein is very tortuous along its strike, at one point making a turn of more than 90°. There are also rolls and swells along the dip of the vein. One pronounced roll occurs at the 500-foot level which caused some difficulty in picking up the vein. In drifting on the vein to the south of the shaft a strong thrust fault was encountered on the various levels. This fault strikes northeast and southwest and dips to the southeast at 67°. Development on the 300-foot level showed the displacement of the southerly portion of the vein to be 90 feet to the southwest along the fault place in the drift. The movement of the fault was, however, in an oblique direction, as shown by grooves on the fault plane. Fragments of vein material



Plan of the third level (300 feet) Porcupine Crown mine, showing geology and intricate block and step faulting to which the vein has been subjected. The reproduction is from plan furnished by M. W. Summerhayes, manager.

were distributed along the fault between the parts of the vein. The ground to the south of the "big" fault for some distance is broken up with minor faults and displacements of the vein. The vein is primarily quartz, but a considerable portion of it is carbonate which sometimes occurs in bands.

There has been fracturing of the earlier constituents and later quartz has been deposited in the transverse fractures. The later quartz is usually of a whiter colour than the earlier quartz. The rocks enclosing the vein belong to the basaltic greenstone series and a later quartz-porphyry. The vein is not in the contact, but usually is not far from the contact of the basalt and porphyry. Owing to the extreme alteration of the rocks along the vein it is not always possible to name the wall rock. Some rich

No. 5 vein, McIntyre mine, showing thrust fault. In the upper left hand corner is the vein above the fault. The hammer rests on a section of the vein (drag ore) in the fault plane. The main portion of the vein below the fault plane was located some distance down the plane of the fault.

portions of the vein have been in the schistose quartz-porphyry, but usually the schistose basaltic rocks have been the more promising wall rock. The chief metallic constituents of the vein are native gold and iron pyrites, while the values are largely confined to the vein itself. A sample of ore carrying much carbonate, from the 200-foot level near the shaft, was examined under the microscope. It contains numerous crystals of plagioclase feldspar, much broken up and invaded by calcite, tourmaline and sericite; quartz grains also occur through the carbonate, and most of the gold is clustered around crystals of iron pyrites, while it was also observed within some of the iron pyrites crystals. It is likely that some of the quartz-porphyry wall rock was included in the vein at this point and impregnated with gold-bearing solutions.

S. W. Cohen, in the annual report of the company for the year ending December 31st, 1914, states that during the year 40,857 tons of ore were treated in the mill. The heads averaged $17.18, the tails 47 cents, while the average extraction was 92.26 per cent. Development showed an ore reserve of 85,000 tons, with a value of $1,510,000, based on mine-sampling. The ore shoot on the 300-foot level was shown to be nearly 1,000 feet long.

McIntyre-Porcupine

The main workings of the McIntyre mine are situated in the N.E. ¼, N. ½, lot 10, concession II, Tisdale. As the western portion of Pearl lake extends into this claim the property has been developed from shafts on the north and south sides of the lake. The rocks are of igneous origin, and have been greatly altered to schist. Toward the north and south boundaries of the property there are areas of altered volcanic rock, basalt and associated lavas, while between them there is a broad band of schistose quartz-porphyry. This rock relationship and the development of the veins from the north and south sides of the lake have led to the following classification of the vein systems:—Veins in the basalt and grey schist, and veins in the contact between the quartz-porphyry and the grey schist on the south side of Pearl lake; No. 5 vein and veins in the contact zone paralleling the north contact between the quartz-porphyry and the basalt on the north side of Pearl lake; Veins in the quartz-porphyry. The term grey schist has been used to designate a fine-grained igneous rock, probably of volcanic origin and associated with the basalt in the volcanic series. Underground development in the quartz-porphyry away from the contact with the grey schist has not been promising for ore bodies. The extreme schistose character and softness of the quartz-porphyry which occurs under the lake has rendered cross cutting even at deep levels a difficult matter, so that connections have not been made between the workings on the two sides of the lake. Development has shown that the most promising locations for gold deposits occur in the altered volcanic schist, and in or near the contact with the quartz-porphyry. Owing to the extreme schistose character of the country rock the ore bodies are very irregular and lenticular in form, particularly to the south of Pearl lake. The ore shoots consist of quartz more or less interbanded with mineralized schist, often widening out and tapering abruptly. The location of the ore bodies has been rendered difficult by the presence of compression faults which have displaced portions of the ore. A. R. Whitman, a mining geologist, has been employed by the mine to study the nature of the faulting and by an examination of the rock structures has succeeded in locating parts of ore bodies which have been displaced by faulting. The most prominent fault so far noted is on the north side of the lake, where on the 400-foot level, on No. 5 vein, the fault has a throw of 130 feet. Various minor thrust faults have also been noted with the throw varying from a few inches to a few feet.

The following additional information has been obtained from the report of R. J. Ennis for the year 1914 and for the first six months of 1915. During the year 1914, 62,209 tons of ore were treated, with an average value of $9.26. The tailing loss was 43 cents per ton, while the extraction was 95.3%. The bullion produced and by-products obtained amounted to $549,255.42. For the first six months of 1915, 48,855 tons were milled for a recovery of $369,294. Since the beginning of operations to June 30th, 1915, the property has produced $1,212,283.34 in gold bullion, the result of milling 152,759 tons of ore. Development at No. 5 shaft has proceeded to the 500-foot level, while at No. 4 shaft ore bodies have been opened up east and west of the shaft on the 600-foot level. The estimated ore reserves at March 31st, 1915, were 109,693 tons, with a value of $854,436.

North Thompson

The North Thompson mine is situated on the S.W. ¼ of S. ½ of lot 10 in the second concession of Tisdale township and lies between the Porcupine Crown and Vipond mines. The rocks exposed on the surface belong to the volcanic series of basalt and related rocks. The ore bodies, which consist of quartz and schist with considerable iron pyrites,

are lenticular in structure and vary greatly along the strike. The development in July, 1915, consisted of drifting on the 100-foot level along No. 1 and No. 5 veins. No. 1 vein strikes approximately N.E. and S.W., whereas No. 5 vein strikes almost N.W. and S.E. Diamond drilling was also utilized to locate ore bodies. A three-compartment shaft was raised from the 100-foot level to the surface, and development was to be continued to deeper levels.

Rea

The Rea mine was operated throughout the year 1914 by a leasing company, Porcupine Aurum Mining Company, which treated 11,607 tons of ore in a small stamp mill by amalgamation obtaining $125,000 in bullion. The same company has since been diamond drilling several quartz veins which outcrop on the property.

Open pit, Dome mine. The ore body consists of quartz veins irregularly distributed in the schist, and overlain by 6 feet of clay and gravel. Sept., 1914

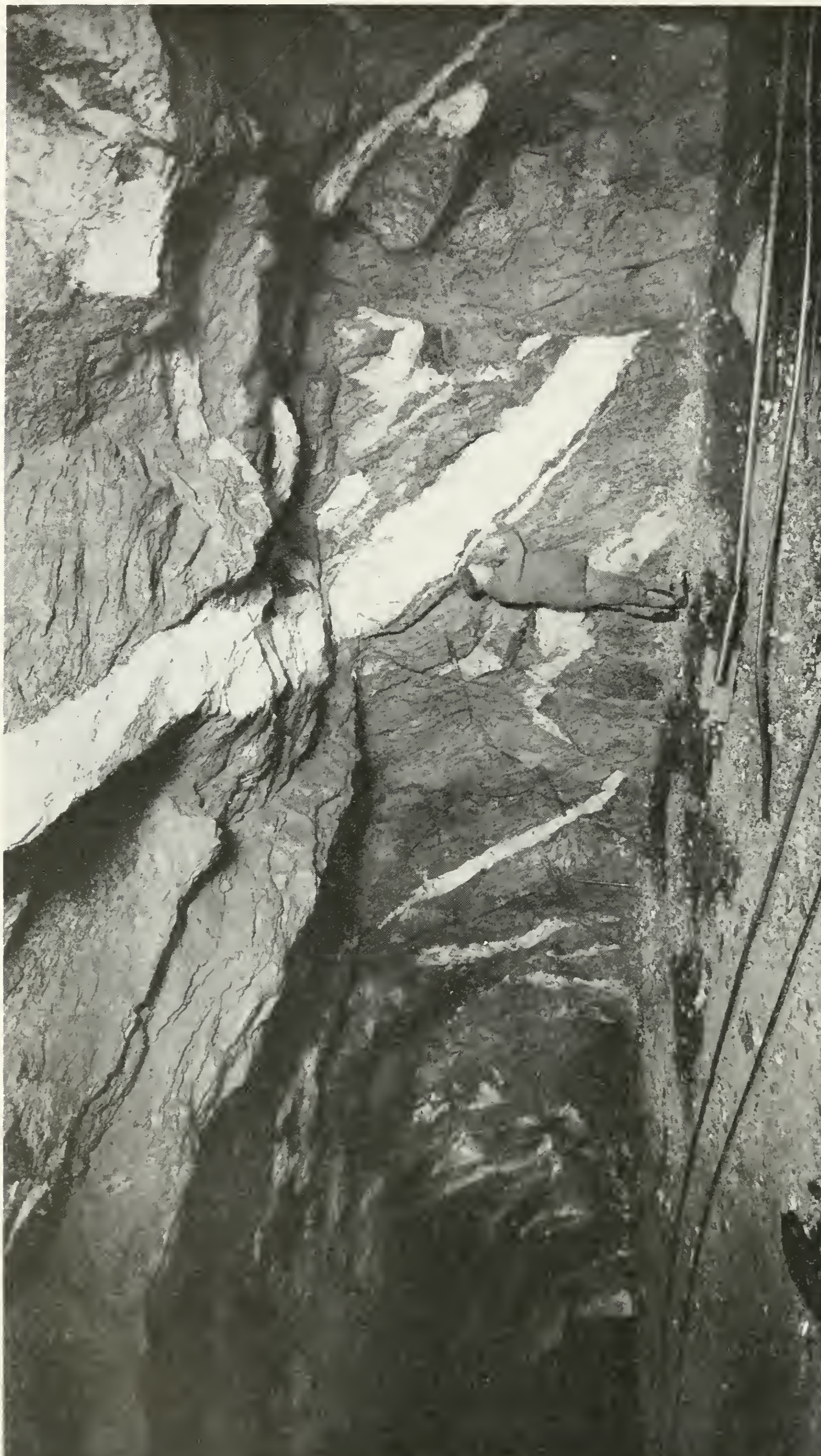
Dome

This property consists of a group of six claims in lots 4 and 5 in the first concession of Tisdale township. The main workings are on the northwest and northeast quarters of the north half of lot 4. The ore bodies occur partly in rocks of the Keewatin and partly in those of the Timiskaming series. The large open pit, or "glory hole," is largely in the sedimentary rocks, but, towards the northwest, Keewatin volcanics are observed. As the open pit is extended westward, more of the Keewatin rocks will be encountered. Slaty conglomerate occurs along the south margin of the pit, while further east on the surface are interbedded greywacké and slate. A mass of altered quartz-porphyry skirts the ore body on the south side, and development underground has shown that the porphyry contact below the 100-foot level dips to the south and

forms the hanging wall of the ore bodies. The rocks associated with the ore bodies, occurring as they do in a disturbed zone, are now greatly altered and are more difficult to recognize underground than on the surface, where weathering has brought out the conglomeratic character of the rock and also the amygdaloidal structure of some of the Keewatin. Underground, the rocks are almost uniformly of a grey colour due to the presence of much carbonate. Altered conglomerate and banded slate were observed in the east workings on the fifth level. The structures of the ore bodies at the Dome in a broad way resemble those at other properties, except that they are not so linear as, for example, those of the Hollinger. They consist of broad lenticular masses of quartz enclosed in schist, narrow lenses or veins of quartz more or less interbanded with the schist, and impregnations of schist with silica and iron pyrites. In this last character of ore there may be very little of the ordinary

Dome-shaped quartz masses in contact with schistose conglomerate, Dome mine, Oct., 1911. The outcrop has been mined in the open pit

white vein quartz. The mineralization may extend over a considerable width, as shown by the dimensions of the large open pit. The ore bodies are not uniformly broad, and mining development has shown blocks of ground in which the values are too low to be extracted profitably, but throughout the now extensive workings there are large blocks of commercial ore which will be broken and treated in the mill. The best values are along the contact of quartz and schist, and visible gold is frequently observed under these conditions. Some of the gold is very coarse in character, particularly some of the surface showings which have now been mined. In the Golden Stairway vein streaks of gold had a thickness of about a quarter of an inch. Iron pyrites is abundant along the contacts, occurring in well crystallized forms contiguous to the veins. Galena and pyrrhotite are occasionally observed in the ore. The accompanying photographs will illustrate the structures encountered in mining operations. Development has shown that some of the rocks are more favourable for ore bodies than others. The conglomerate and greywacké of the Timiskaming series contain better



Ore body on 4th level, Dome mine. A fault is indicated at the right side of the illustration

deposits than the finely-banded slates which are not so open for percolation of solutions. The fine-grained amygdaloidal rocks are also not so favourable as the coarser-grained volcanics. The quartz-porphyry has not been proven to carry commercial ore bodies. A dike of fresh diabase, about thirty feet in width, cuts the vein-bearing formation to the west of the open pit. It has been encountered in the workings on the first and third levels. This rock is much later in age than the mineralization of the schist. The ore bodies have a general northeast and southwest strike.

In the deeper levels the workings are being laid out in a rectangular system with the drifts northeast and southwest, and cross-cuts northwest and southeast.

The following information is taken from C. D. Kaeding's statement in the fourth annual report of the Dome Mines for the year ending March 31st, 1915:—

"During the year a total of 265,597 tons was mined and hoisted. Of this 248,550 tons was ore which went to the mill and 17,047 tons was waste which went to surface dumps. All of the 248,550 tons of ore was milled, resulting in a net yield of $1,055,496.78, the average being $4.25 per ton."

"The development work has been distributed on the various levels and within a zone 1,500 feet long by 400 feet wide. Besides definitely determining the two million tons 'indicated' by incomplete development a year ago in the vicinity of No. 2 shaft there has been developed, in addition, a large body of better grade ore on the 4th and 5th levels of a character similar to that originally milled from the so-called 'Dome.' This latter ore has its apex it would seem at the 3rd level, or 260 feet vertical from the surface. At the 4th level, 330 feet vertical, it is 330 feet long and 120 feet wide. On the 5th level, 424 feet vertical, it is 160 feet long and 60 feet wide. Below the fifth level and extending to the 6th level a vertical distance of 130 feet the latest results obtained by diamond drilling have been satisfactory, and indicate a further tonnage. In the earlier drilling, as stated in previous annual reports, hole No. 20 drilled from the surface at a 60° angle flattening to 45° showed 478 feet of $3.69 ore; that portion of the hole between the 5th and 6th levels showed 4 intersections of ore totalling 119 feet, averaging $5.63. As related to this, hole No. 52 drilled from the 6th level horizontally from a point 40 feet southwest of No. 2 shaft has shown five intersections of ore totalling 127 feet, averaging $4.42. Confirmatory to this hole No. 53 drilled on the 6th level horizontally parallel to and 75 feet east of hole No. 52, showed two intersections of ore totalling 233 feet, averaging $7.28."

The results obtained by diamond-drilling on the 6th level are not included in Mr. Kaeding's estimate of ore reserves which on April 1st, 1915, was:—

Tons.	Value.	Total.
2,782,811	$4.15	$11,576,858.71

The following table gives the ore value, bullion and recoveries at the mill for the year ending 31st March, 1915.

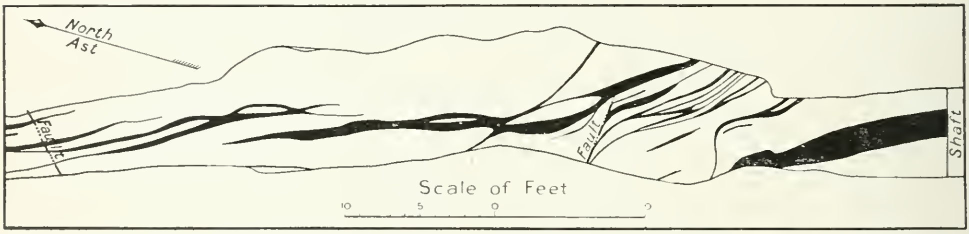
		Per ton.		Per cent. Extraction.
Value of ore sent to mill, 248,550 tons		$4.68	$1,163,954.80	90.6
Bullion by amalgamation	$671,054.44	2.70	57.6%	
Bullion by cyanidation	384,442.34	1.54	33.0	
Total bullion	$1,055,496.78	$4.24+		90.6

Dome Lake

The predominant rocks at this mine are altered volcanics of a basic type, while ellipsoidal and amygdaloidal structures are frequently observed. The rocks are somewhat schistose with a strike nearly east and west and dip 80° north. Shear zones have been developed along the direction of schistosity and along the planes of these zones lenses of ore have been formed. Development has shown that there are a number of

small ore shoots along the direction of No. 3 vein, which is the most important one so far discovered. Between the ore shoots the vein structure may disappear, therefore at times the finding of the ore shoots on the different levels is difficult. Development has shown that the ore shoots pitch to the east at about 48° and that the pitch length is frequently greater than that along the drifts. One ore shoot has been followed from above the 60-foot to the 400-foot level with a pitch length of at least 350 feet, while the drift length averages about 45 feet. The ore shoots are usually narrow, averaging less than three feet in width. One shoot with a width of three feet showed a value of $22 over 40 feet in length.

The vein material is usually of a fine-grained character, consisting of altered country rock, which has been largely replaced by fine-grained carbonate and silica. Some of the ordinary coarser-grained, whitish quartz also occurs in the ore. The ore shows several generations of quartz and carbonate. There is also considerable iron pyrites in the ore, while the gold is usually very fine. Metasomatic alteration of the wall rock is well shown at No. 1 vein, just east of shaft No. A. The rock is basalt showing amygdules of white quartz. Near the vein the basalt is altered to carbonate, weathering on the surface to a rusty brown colour, while the white quartz amygdules have been preserved throughout the altered basalt. Vein No. 1 contains a high percentage of carbonate which is intersected by quartz veinlets.



Plan of the 50 foot level, Porcupine Pet, H.R. 907. Deloro township, showing the reticulated structure of the auriferous quartz veinlets in the quartz-porphyry

About 50 tons of ore averaging $12.60 per ton are treated daily in the ten-stamp mill. The mill is equipped with a tube mill for fine grinding, after which the ore is passed over amalgamating plates. The tailings are classified into sands and slimes which are passed over concentrating tables. The high grade concentrates, of which about ninety tons had been saved up to the end of May, 1915, are shipped to a smelter.

Porcupine Pet

The Porcupine Pet mines (mining claim H. R. 907, Deloro township) was in operation during portions of the years 1914 and 1915. The ore raised from the 50-foot level was treated in a small mill, which is equipped with two Nissen stamps and amalgamating plates, classifiers, sand and slime concentrating tables.

The country rock is quartz-porphyry. This rock is intersected by numerous quartz veinlets which are usually only a few inches in width. These veinlets occur in a somewhat reticulated structure, with most of the veinlets striking a few degrees to the west of north. Some of the nearly vertical veinlets over short distances carried considerable gold in grains as large as peas. In addition, some ore was taken from a vein along a fault plane which occurred in the roof of the drift. The quartz in the veinlet had been greatly brecciated, while the fault plane contained considerable clay and grains of gold. The porphyry along the veins is greatly altered to sericite and other secondary minerals, being light green in colour. The gold-bearing quartz veins carry in places pyrite, galena and zincblende.

Davidson

This property is situated in the northeast part of Tisdale township. The main country rock is a light greenish weathering basalt, frequently showing pillow structure. Shear zones have been developed in parts of the greenstone series. These are recognized by the rusty weathered surface. Quartz lenses have been developed in different parts of the shear zones which have also been impregnated with carbonate and iron pyrites. The general dip of the main shear zone is to the north at about 60°. At the Davidson this zone is about 90 feet in width, while toward the southerly or foot-wall side quartz lenses have been developed in a direction N. 70° E. with a dip 61° N.W. On the surface an ore shoot 50 feet in length, with a value of $15 per ton over a width of 12 feet, was determined. The best values exist where inclusions of altered rock are found in the quartz, the gold usually occurring near the contact of the two and associated with the

Narrow quartz veins (auriferous) cutting conglomerate at Three Nations Mining Co., Sept., 1911

iron pyrites. Mining at the property consists of a shaft 242 feet in depth, with drift and crosscuts at the 100 and 200 foot levels. An ore shoot which may be the continuation of that encountered on the surface, was located on the 100-foot level, at a point which would indicate that the shoot has a strong pitch to the west. The ore shoot on this level was drifted on for 40 feet and over a width of 5 feet 6 inches gave an assay value of $21.60 per ton. The development work on the 200-foot level when discontinued had failed to locate a pay shoot.

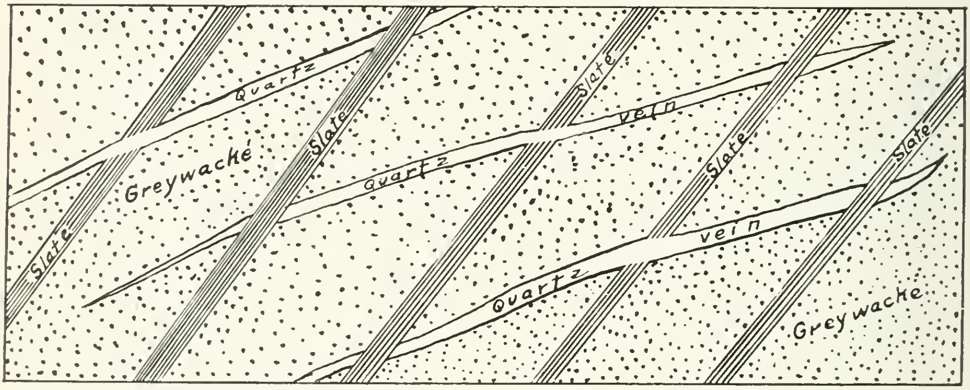
Porcupine Lake

An inclined shaft was sunk to a depth of 275′ and crosscuts and drifts run to locate a mineralized zone which had been cut by diamond drilling. The acreage of this property is mostly under Porcupine lake so that most of the exploration must be done by underground work. Only a very small outcropping shows on the east side

of the lake where visible gold was discovered in a shear zone in which lenses of fine-grained quartz occur in the schist. The strike of the schist zone is northeast and southwest, while the dip is 60° northwest. This zone has been traced for 750 feet on the surface by means of trenches.

Three Nations Lake

This property is situated in the northeast part of Whitney township to the west of Three Nations lake. The veins occur in rocks of the Timiskaming series. A number of narrow quartz veins from 2 inches to 6 inches in width were first found. These contained visible gold but were too small to be workable. Later a quartz vein averaging about 3 feet in width, with strike northeast and southwest and dip 70° south was located. A shaft was sunk to a depth of 300 feet. The ore body on the surface was about 300 feet in length while development showed that the ore body became shorter at depth, extending about 40 feet below the 200-foot level. The ore body was confined to rocks of a greywacké type, being cut off to the southwest by finely banded dark slate, and to the northeast by conglomerate. The principal gangue in the ore is white quartz. Iron pyrites and zincblende are the principal sulphides. A shaft was



Sketch showing how narrow quartz veinlets in some cases have not continued through the slaty bands of the Timiskaming series, La Palme property, Whitney township

also sunk on the contact of the basalt and the conglomerate, near the north line of the property. Here the rock has been greatly silicified and impregnated with carbonate and iron pyrites. A cross cut on the 100-foot level connects this shaft with the workings at the main shaft. While the property was in operation some ore was treated in a small stamp mill by amalgamation.

La Palme

On the La Palme property there are a number of narrow quartz veinlets, varying from a fraction of an inch up to 7 inches in width. Showings of coarse visible gold occur in a number of the veins. The strike of the veins varies from that of the enclosing conglomerate and greywacké. The rocks dip steeply to the north, whereas the veins dip to the south at about 45°.

The forces which produced these narrow veins must have acted very gently. Veins have been formed which can be traced through quartzitic bands ending abruptly at the slaty band, and continuing beyond in another quartzitic band. The fissures were more readily produced in the brittle quartzite than in the tough slate.

Wright Claims

Work is being done in Deloro township on a group of claims known as the Wright claims R.S.C. 175 and 176. These are about 5 miles south of South Porcupine. Here there are bands of iron formation which have a general strike, north and south, and varying dip to the west. The formation lies in Keewatin rocks, agglomerate and lava, which dip similarly to the iron formation. The iron formation is greatly disturbed and over short distances is very tortuous. It consists of interbanded silica and magnetite and varies from about 20 to 30 feet in width. There are veins and irregular masses of quartz in parts of the formation. These usually cut across the strike and are associated with the occurrence of the gold. Iron pyrites in large well-developed crystals is abundant in parts of the deposit, while copperpyrites is also present. The gold occurs with the quartz veins and the iron pyrites. Samples show native gold deposited on the faces of the crystals of pyrite. A vertical shaft is being sunk on the deposit, and in July, 1915, this had reached a depth of 40 feet, at which depth the deposit was dipping to the west of the shaft. In the development so far accomplished, there is considerable quartz veinlets and iron pyrites showing, and satisfactory assays are reported to have been obtained from the development work.

Metallurgical Practice

An article on the "Metallurgical Practice in the Porcupine District"[22] by Noel Cunningham, has recently been published. Discussing the character of the ore Mr. Cunningham states that "The precious metal content is about in the proportion of 85 of gold to 15 of silver by weight." From a milling standpoint there are two classes of ore having very different characteristics. "Class A ore is a pure quartz with inclusions of schist. Generally it is heavily fractured and breaks down readily to sharp hard grains, about minus 10 plus 20 mesh, requiring further comminution to release the gold. It carries very little pyrite. The gold is entirely free and apt to be coarse, but often spongy, going into solution readily on that account. This gold is 60% to 85% free milling, depending on the grade of the ore." "Class B is an iron silicate schist, strongly laminated, carrying 4 to 5 per cent. pyrite; its specific gravity is 2.8 to 3.0, depending upon the amount of mineralization. In breaking the ore in the mine, generally over 25% of material through a ½ in. ring is made; the ore readily breaks down in milling and makes a comparatively large amount of non-crystalline slime; owing to its high specific gravity, however, it is quick settling. In my opinion the gold in this ore is free, but so finely divided that it will neither pan nor amalgamate. It appears to be disseminated through the rock and not chiefly associated with the pyrite. Veins of Class A ore occur with or without side walls of Class B, and veins of Class B occur unassociated with Class A; more often the veins are closely banded; Class A and Class B alternating, generally with Class B in excess. Both classes of ore are more or less blocky at times, and with reference to Class B this is indicative of low gold content." "From a treatment standpoint neither class of ore introduces any important difficulty, although there seems to be a tendency toward precipitation, due probably to some element in Class B material. Practically no cyanicides are present in the ore, chemical consumption being about 0.2 lbs. of cyanide per ton of ore; 1 lb. cyanide solution is sufficient for extraction, and protective alkalinity may be carried very low. With a well-designed battery and tube mill installation a stamp duty of 15 tons or better can be readily maintained." The following summary of mill treatment is also taken from Mr. Cunningham's report:

"Vipond—mill of 100 tons capacity treating a mixture of Class A and Class B ore. Treatment—Fine grinding in cyanide solution, agitation and complete counter-current decantation.

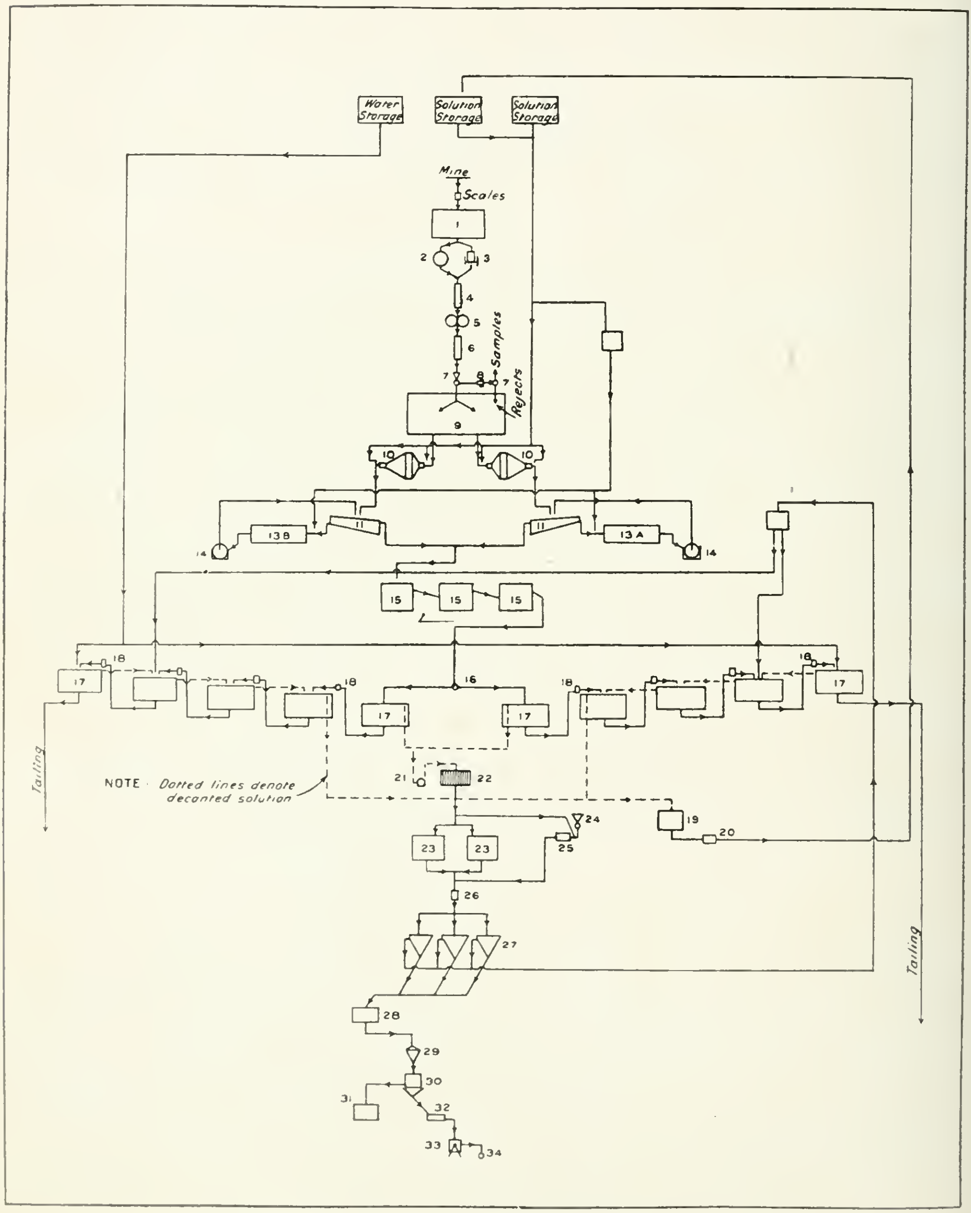
"Dome—80 stamps treating a mixture of Class A with a less amount of Class B ore. Treatment—Stamping tube milling and plate amalgamation in water. Cone classifica-

[22] Bulletin of the American Institute of Mining Engineers, March, 1915.

tion to three products (a) slime, dewatered and agitated in cyanide solution, Merrill filters to waste; (b) sand-leached; (c) concentrate, reground in tube mill in closed circuit with classifier and amalgamation plate, classifier overflow to slime treatment.

"Porcupine Crown—20 stamps treating Class A ore. Treatment—stamping and fine grinding in solution, with plate amalgamation in closed circuit with tube mill and classifier, followed by agitation and complete counter-current decantation.

"McIntyre—mill of 300 tons capacity treating a mixture of Class A, with a large preponderance of Class B ore. Treatment—fine grinding in cyanide solution, agitation, continuous decantation.



Flow sheet for 300 ton cyanide mill, McIntyre Porcupine Mines, Limited.

Index to Numbers on Flow Sheet

1. 200-Ton Receiving Ore Bin.
2. No. 4 Gyratory Crusher.
3. Auxiliary 10″ x 20″ Blake Crusher.
4. 7″ x 12″ Bucket Elevator.
5. 36″ x 16″ Traylor Rolls.
6. 7″ x 12″ Bucket Elevator.
7. Automatic Sampler.
8. 7″ x 12″ Mitchel Sampler Crusher.
9. 500-Ton Storage Bin.
10. 6′ x 16′ Hardinge Ball Mill.
11. Dorr Duplex Classifier.
12. Strong Solution Tank.
13A. 5′ x 22′ Tube Mill.
13B. 5′ x 16′ Tube Mill.
14. 54″ x 10″ Frenier Pump.
15. 16″ x 24″ Dorr Agitator.
16. Mechanical Distributor.
17. 30″ x 10′ Dorr Thickener.
18. 4″ Diaphragm Pump (McIntyre Type).
19. Sump.
20. 7″ x 9″ Triplex Pump.
21. 3″ Centrifugal Pump.
22. Clarifier.
23. Pregnant Solution Storage.
24. Zinc Feeder.
25. Emulsifier.
26. 7″ x 9″ Triplex Pump.
27. 36″ Precipitating Press, 23 Leaves.
28. 4′ x 8′ Acid Treatment Tank.
29. Montejus.
30. 18″ Filter Press, 31 Leaves.
31. Acid Wash Sump.
32. Drier.
33. Bullion Furnace.
34. Bullion Mould.

"Hollinger—60 stamps, treating a mixture of Class A and Class B ore, the latter predominating. Treatment—Stamping in solution, fine grinding and concentration, concentrates agitated in strong solution, washed and impounded; table tails to two steps of continuous decantation, to filters to waste."

Since Mr. Cunningham's article appeared, 40 stamps have been added to the Hollinger mill to treat ore from the Acme mine. Treatment—stamping and fine grinding in solution, agitation, concentration, concentrates to be reground in solution, agitated, washed and impounded, table tails treated by decantation."

Regarding the treatment at the Hollinger mill, P. A. Robbins in his annual report for 1914 states: "Present milling practice adheres closely to the lines laid down in the original mill except that we are now about to resort to continuous decantation for the gritty, quick settling portion of the ore, while the more flocculent portions will continue to be treated in our filter plant. It is anticipated that the final practice in the mill will be—amalgamation for nuggets, settling or filtration for slimes, continuous decantation for sands, regrinding and increased agitation for concentrates."

A plant is now in operation at the Hollinger for treating a portion of the tailing from table concentration by agitation and complete countercurrent decantation.

Small stamp mills have been erected at several of the smaller mines where the gold is partly recovered by amalgamation. The development has not been sufficient to warrant the erection of cyanide plants. These include the Dome Lake, Rea, Porcupine Pet and Three Nations.

Production

The gold production from Porcupine from 1910 to 1915 (9 months) is shown in the following table: [23]

Year.	Ounces.	Value.
1910	1,947	$35,539
1911	765	15,437
1912	83,725	1,730,628
1913	207,748	4,294,113
1914	251,131	5,190,794
1915 (9 months)	255,993	5,295,086
Total	801,309	$16,561,597

During the first nine months of 1915 the Porcupine mines produced 45,416 ounces of silver with a valuation of $22,094.

[23] The figures given in these tables are from returns made to the Bureau of Mines from the Companies themselves.

APPENDIX I

THE KAMISKOTIA LAKE AREA

By A. G. Burrows and P. E. Hopkins

The Kamiskotia Lake area, which is about 16 miles northwest of Porcupine, has attracted some attention since 1910. The canoe route from Mattagami landing, by way of the Mattagami and Kamiskotia rivers to Kamiskotia lake, is used during the open season, while an overland trail from the Mattagami river, by way of the Lally mine in Turnbull township, is also frequently used.

Topography

Kamiskotia lake, nearly two miles in length, is situated in Robb township, which lies directly north of the township of Turnbull where several gold-bearing veins have been found. The most prominent topographical feature near Kamiskotia lake is a high hill of diabase which lies about three-fourths of a mile southwest of the lake. The hill has been greatly burned over, standing out as a monadnock about 150 feet higher than the surrounding country. The area on the whole is drift-covered, and a portion to the west of the lake and lying to the east of the northerly extension of the diabase ridge would be suitable for farming purposes, having been burned off almost cleanly. Fine potatoes and turnips were grown successfully on a large island in Kamiskotia lake. To the north of the lake there are sand and gravel ridges stretching for some miles. One conspicuous ridge, probably of glacial origin, from the top of which the town of Timmins can be seen, runs northward from the Indian encampment along the east side of Moon lake.

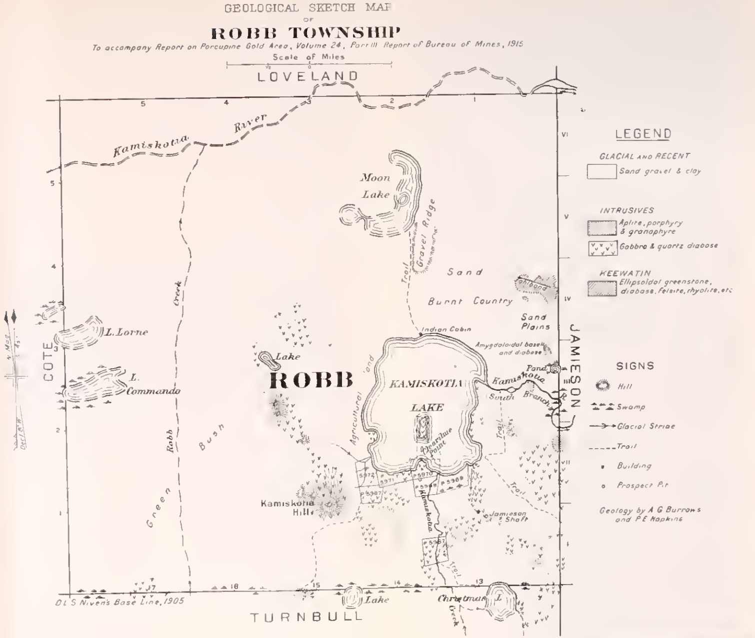
Geology

The rocks around Kamiskotia lake are of pre-Cambrian age, are almost totally igneous and are generally massive in character. They belong to the Keewatin and later periods.

Glacial and Recent	Sand, gravel, clay.
Pre-Cambrian	
INTRUSIVES	Aplite, porphyry, granophyre, gabbro and quartz-diabase.
KEEWATIN	Ellipsoidal greenstone (basalt, etc.), diabase. felsite, rhyolite, chert.

Keewatin.—Those rocks that are recognized as Keewatin are not nearly so prominent as the intrusive rocks.

Basalt occurs just south of the Kamiskotia river where it is crossed by the line between the townships of Robb and Jamieson. It occurs again in two small areas in Robb township to the north of the river and opposite concessions 3 and 4 Jamieson township. Some of the basic rock has an ellipsoidal structure and also contains amygdules. In the northerly exposure there is a band of light grey-weathering rock which has abundant amygdules of calcite. The rock, on chemical and microscopical examination, is a rhyolite. An analysis gave the following percentage composition: silica, 74.94; alumina, 11.97; ferrous oxide, 1.51; ferric oxide, 3.22; lime, 0.50; magnesia, 0.54; potash, 3.64; soda, 2.68; water, 1.08; carbon dioxide. 0.50. Phenocrysts of quartz are readily recognized in hand specimens, and under the microscope these are set in a fine-grained groundmass in which there are smaller crystals of albite and quartz. A


GEOLOGICAL SKETCH MAP
OF
ROBB TOWNSHIP
To accompany Report on Porcupine Gold Area, Volume 24, Part III Report of Bureau of Mines, 1915
Scale of Miles
LOVELAND
COTE
JAMIESON
TURNBULL
ROBB
Kamiskotia River
Moon Lake
Gravel Ridge
Trail
Sand
Burnt Country
Sand Plains
Pothole
Indian Cabin
Amygdaloidal basalt and diabase
Pond
Kamiskotia South Branch R.
KAMISKOTIA LAKE
Pearl Point
Agricultural land
L. Lorne
L. Commando
Lake
Robb Creek
Green
Bush
Kamiskotia Hill
Kamiskotia
Jamieson Shaft
Christmas L.
Creek
Lake
O L S Niven's Base Line, 1905
LEGEND
GLACIAL AND RECENT
Sand gravel & clay
INTRUSIVES
Aplite, porphyry & granophyre
Gabbro & quartz diabase
KEEWATIN
Ellipsoidal greenstone, diabase, felsite, rhyolite, etc
SIGNS
Hill
Swamp
Glacial Striae
Trail
Building
Prospect Pit
Geology by A G Burrows and P E Hopkins

microscopic intergrowth of quartz and feldspar is abundant. Pressure lines have been developed in the rock, and along these there are hornblende, chlorite and calcite. Some of the basalt is much altered with abundant amygdules of chlorite, epidote and other minerals. Associated with these volcanic rocks there are narrow bands of cherty sedimentary material. A felsitic rock occurs just west of the fifteenth mile-post on the south boundary of Robb. This rock is cut by gold-bearing quartz veins.

Intrusive Rocks.—Most of the outcrops in Robb township are intrusive rocks, generally of basic composition. The predominant intrusive is a dark grey gabbro-diabase which composes most of the ridges in the south part of the township. The prominent hill before mentioned consists of this rock. The gabbro-diabase rock is often very coarse in texture, crystals up to an inch in length sometimes being developed. There is frequently a layered or banded structure which was probably produced during the cooling of the magma by a separation into light and dark bands, composed in the one case of an excess of feldspathic constituents and in the other pyroxenic constituents.

Overlooking Kamiskotia lake from diabase hill to the southwest. July, 1910

A sample of quartz-diabase from the east side of Kamiskotia lake contains labradorite, augite, partly altered to hornblende and chlorite, and an intergrowth of quartz and feldspar. Accessory minerals are ilmenite and apatite.

Differentiation from the normal diabase is shown east of Kamiskotia lake at several places. A sample of the micropegmatite from the east boundary of Robb about one mile south of Kamiskotia creek contains about 60 per cent. of an intergrowth of quartz and feldspar. There are also small amounts of hornblende, chlorite, quartz grains, calcite, sericite and magnetite.

A quartz-porphyry from twenty chains west of Godfrey and four chains south of Robb contains about 50 per cent. of quartz phenocrysts, showing corroded edges, while the groundmass is microcrystalline and consists of quartz, feldspar, sericite, chlorite and leucoxene.

Economic Geology

Gold has been discovered in several parts of Robb and Turnbull townships. The most important discoveries so far made are on the Jamieson claim, which is about three-quarters of a mile southeast of Kamiskotia lake. The predominant rock is a coarse-

grained diabase or gabbro which has been intruded by acidic dikes, probably derived from the same magma. On the north part of the claim one of these dikes strikes N. 42° E., and varies where exposed from six to fifteen feet. The dike is intersected by veinlets of quartz, in a somewhat reticulated structure, which vary in width from a fraction of an inch to several inches. The visible gold occurs in the quartz veinlets. In September, 1914, a pit was being sunk on the northeast part of the dike. The quartz in the veinlets is associated with some iron and copper pyrites, tourmaline and calcite. Other showings on the claim are in veinlets in the gabbro. One open cut, about seventy-five feet long and six feet deep, was made in the gabbro, which showed much pink feldspar. Visible gold could be observed at a number of points in the open cut in quartz veinlets which intersected the gabbro.

Just west of mile-post XV on the south boundary of Robb township a felsitic dike intrudes an old diabase. Two shallow pits were sunk on the dike where it is intersected by quartz veins. The quartz contains some iron pyrites, and visible gold is reported to have been found in the quartz in 1910.

On the Christman claim on the northeast part of Turnbull township considerable work was done on a quartz vein, with strike N. 33° W., which had been traced for 120 feet. The vein consists in places of narrow quartz veins with interbanded rock. The quartz carries in places iron and copper pyrites. One sample from a twelve-foot pit gave on assay low values in gold.

The Lally mine is situated near the east boundary of Turnbull township, about three miles from the north boundary. The country rock is porphyry, which contains a number of quartz veins with an approximate north-and-south strike. The larger veins are connected by cross veinlets of quartz, giving the character of a stockwork. Two shafts, forty and sixty feet in depth, had been sunk on the quartz and porphyry when the property was visited in September, 1914, while the sixty-foot shaft was to be continued to the 100-foot level and the vein drifted on. Some of the quartz contains visible gold.

A large mass of quartz "float" weighing several tons was found five chains northwest of mile-post XVII on the south boundary of Robb and was broken up by prospectors. Visible gold was noted in some of the fragments of the boulder, and attempts were made to find the vein from which the mass was derived, but, owing to the extremely drift-covered character of the country for some miles to the north, the attempt was unsuccessful. A sample from the boulder which was considerably stained with iron oxide gave on assay $4.80 in gold.

APPENDIX II

WATER POWERS IN THE PORCUPINE AREA

By W. R. Rogers

Accompanying the reports on the Porcupine Gold Area by A. G. Burrows in Volumes XX. and XXI., Ontario Bureau of Mines, were short articles by the writer on the water powers of the region. It is not the intention here to present a memoir, but rather to supplement the subject matter of the above mentioned articles and incidentally point out some important factors in the development of hydro-electric power with particular reference to northern Ontario conditions. Information kindly furnished for this Appendix by officials of the Northern Canada Power Company and the Hydro-Electric Power Commission of Ontario is gratefully acknowledged.

During the early days of mining camps in northern Ontario steam power from wood fuel is used in the preliminary working of prospects As development proceeds

Sketch map showing location of power plants on the Mattagami river at Wawaitin and Sandy Falls, also transmission lines to the Porcupine mines

timber in the immediate neighbourhood is soon exhausted, and then either coal or hydro-electric energy must be resorted to for power purposes.

All the hydro-electric power furnished the Porcupine camp comes from two plants situated on the Mattagami river, a tributary of the Moose flowing into James bay. The location of the power plants with respect to the mining area is indicated on the accompanying sketch map. Both of these were formerly independent plants, but now are controlled and operated by the Northern Canada Power Company, Limited. The two plants are provided with interswitching facilities, so that they work continually in parallel. The new company has expended a great deal of money in new construction, replacements, and betterments, so as to guarantee to power users continuous and satisfactory service.

Sandy Falls

The first development was that at Sandy falls, six miles northwest of Timmins, which is the terminus of the Porcupine branch of the Timiskaming and Northern

Concrete dam replacing timber structure at Sandy falls

Ontario railway. Power was available from this development in June, 1911, and a saw mill operated on the east bank of the Mattagami river before the mines were ready to use electric energy—a unique experience in a new mining camp.

Two units are installed in the power house with a total capacity of 2,500 horse power. It is the intention to instal another unit, thus doubling the capacity. The effective head is 35 feet. During the summer of 1913 extensive improvements to the plant were undertaken. The timber dam is now replaced by a concrete structure from which water is carried to the power house by a 9-foot wood stave and an 8-foot steel penstock.

A continuous record of the flow of the river has not been kept, but several measurements have been made during low-water periods in different years and meter records are appended herewith:

January 20, 1910	1,654 cubic feet per second.
[1] March, 1910	517 " " " "
[2] March 25, 1912	633 " " " "
March 25-26, 1914	500 " " " "

A meter record taken July 4, 1911, at Cypress falls some miles down the river gave a discharge of 3,351 cubic feet per second. Here the drainage area is estimated at 4,500 square miles, whereas at Sandy falls it is only 2,500 square miles. Reducing the reading

View from intake of power house showing surge tanks and wood stave penstocks at Sandy falls, Mattagami river, township of Mountjoy

on this basis would give a flow of 1,862 cubic feet per second at Sandy falls on the above mentioned date.

From the available records it will be seen that 500 cubic feet per second may be assumed as the extreme low-water natural discharge. This is equivalent to only 1,600 horse power, while the total capacity of the present installation is 2,500 horse power. Consequently controlled storage must be resorted to for increasing the minimum flow. This is now provided for above Wawaitin falls.

[1] Estimated from Sandy falls records on the same basis as readings for March 25-26, 1914, taken at both places.

[2] Seventh Annual Report, 1915, Hydro-Electric Power Commission of Ontario, p. 362.

Wawaitin Falls

The power house at Wawaitin falls is distant 11 miles southwest of the town of Timmins. This plant was not ready to supply power until the autumn of 1912. From the dam at the foot of Kenogamisee lake, an expansion of the Mattagami river, there is an open canal 1,200 feet long from which water is led through two 9-foot wood stave penstocks, each 1,500 feet in length, to a surge tank, 40 feet in diameter, on the crest of the hill overlooking the power house. From the surge tank two 8-foot steel penstocks, each 1,300 feet long, lead to the power house. The operating head is 125 feet. At present two units are installed with a total capacity of 7,000 horse power. Canal and head works, however, are arranged so that the power house can be extended and two more units added, thereby doubling the capacity.

Meter records available at this point under natural flow are as follows:

March, 1910	366 cubic feet per second.
July 15, 1911	792 " " " "
March 16-30, 1913	195 to 240 " " " "
March 25-26, 1914	354 " " " "

The Cypress fall record for July 4, 1911, corrected for a drainage area of 1,000 square miles instead of 4,500, would give a natural flow of 745 cubic feet per second. This record corresponds closely with that for July 15, 1911. Assuming 200 cubic feet per second as the minimum natural flow, the horse power resulting would be only 30 per cent. of the present capacity of the power plant, hence the necessity for storage.

From the records it would appear that a run-off co-efficient of 0.2 cubic feet per second per square mile of drainage area may be taken as representing the minimum flow of the Mattagami river under natural conditions.

Storage

Storage of water is perhaps the most vital point in connection with any hydro-electric development. It is absolutely essential that the water supply be continuous. High-water periods in northern Ontario are at the time of the spring breakup, and to a much less extent during the late autumn, when rains are usually fairly abundant. February and March have been the months when water becomes scanty, particularly in those winters when the usual thaws did not occur. How to provide for low-water periods without reliance upon auxiliary steam plants is a problem that can be solved only when abundant storage is possible. The experience of the power plants on the Mattagami river has very definitely established this fact.

Pondage may be considered as the close-at-hand storage of water immediately available for use in the turbines. It is a necessary precaution in Ontario water powers in order to provide against ice troubles as well as to meet local fluctuations in power needs during the day. Three distinct types of ice are met with: surface or sheet, anchor, and frazil. The first, in addition to restricting the area of the channels, is liable to cause jams in the spring, cutting off the water supply or raising the tail water with a consequent loss of head. Anchor ice frequently rises in large masses, often carrying boulders and soil which are liable to damage the ice racks. Frazil ice, in the shape of needles, forms in rapids when the temperature is slightly below the freezing point. These needles or crystals gather in lumps and adhere readily to any surface with which they come in contact. Trouble from these latter sources is avoided when a long stretch of still water exists above the power house, while surface ice trouble is largely overcome by proper dam construction.

Prior to the erection of the large plant of the Abitibi Power and Paper Company at Iroquois falls, on the Abitibi river, where an installation of 19,500 horse power was first

[3] Seventh Annual Report, 1915, Hydro-Electric Power Commission of Ontario, p. 362.

Power house, Wawaitin falls, Mattagami river, township of Thorneloe. Eight-foot penstocks lead from the surge tank at the crest of the hill to the power house

View of Wawaitin power house looking down the line of eight-foot penstocks (covered). A new nine-foot wood stave penstock has been added recently

operated in Aug., 1914, the two power plants on the Mattagami river were the only ones in Ontario on the James Bay slope. Consequently, their experience is of value to other power developers and users. The James Bay drainage basin is very conservatively estimated[4] as capable of developing 1,500,000 horse power, or 30 per cent. of the total potential water power of the Province of Ontario.

When the meter record of March 25-26, 1914, was taken at Wawaitin the total flow was 518 second feet, of which 164 was drawn from a storage basin of 33,000 acre-feet. During the winter of 1914-15 a new dam was built at Kenogamisee falls, increasing the storage capacity to 100,000 acre-feet. This reservoir should be ample to supplement the flow at low-water periods. Kenogamisee lake, the original reservoir, is shallow, and the water available is considerably lessened in late winter by a two-foot covering of ice.

Floods and Forests in Relation to Storage

Floods are reduced in magnitude and stream flow rendered more constant where the drainage basin at headwaters is forested. For the most part northern Ontario is a forested area, but, where such is not the case, reforesting, particularly at the sources of streams, as an aid to reliance upon storage reservoirs, seems a necessary precaution of the future in order to prevent disastrous floods, and to equalize as much as possible the stream flow throughout the year. Floods may do little damage at present except to power installations, so the ideal conditions will not receive much attention until some future time when a shortage of power makes their consideration urgent.

Sometimes the topography of drainage areas precludes the possibility of providing large storage reservoirs. In northern Ontario water storage above the natural high-water mark on streams and lakes is not desirable, as it results in killing the timber along the banks and shores, giving the country a most desolate and deserted appearance. The consensus of opinion favours storage at or near the sources of streams, thereby preventing a combination of conditions which usually occasion disastrous floods in the areas adjacent to the lower stretches of the river.

In the particular case of the Mattagami river, the present storage not only helps the power plants already in operation, but will improve the conditions for future developments farther down the river. At eight different points down stream where surveys have been made, the farthest of which is only 75 miles north of the Transcontinental railway, it is possible to develop a total of 149,235 horse power under natural conditions. In this estimate the co-efficient used for minimum low-water discharge is 0.3 c.f.s. per square mile of drainage area. Records at Sandy and Wawaitin falls indicate that 0.2 is the proper co-efficient. This would reduce the estimate of undeveloped energy on the Mattagami river to 100,000 horse power. Storage facilities, with the exception of those already mentioned in connection with the Wawaitin development, are very meagre, and consequently the river cannot be described as well regulated in its natural condition.

Power Shortage

In his statistical review[5] T. W. Gibson points out some of the power difficulties that have been experienced, and refers briefly to the auxiliary steam plants that have been provided by the larger mines to meet emergencies resulting from electric power shortage.

During the winter of 1911-12, owing to extreme low water, there was a shortage of power for operating the Porcupine mines, but since that date the Wawaitin falls development has been completed and the Sandy falls plant improved and enlarged. Despite this increase of capacity there was again a decided shortage of water during

[4] Water Powers of Ontario, by H. G. Acres, prepared for Dominion Water Powers Branch exhibit at the Panama-Pacific Exposition, 1915.

[5] Ont. Bureau of Mines, Vol. XXIV. (1915), Part I., p. 7.

the winter of 1914-15 that was not relieved until the second week in April, 1915, thereby seriously interrupting the work of the mines and curtailing the gold production.

In the Porcupine camp provision has been made, to the extent of about 2,500 horse power, to meet periods of power interruption. This is notably the case at the Hollinger mine, where two new compressors, driven by synchronous motors, have been arranged so that they can be turned into steam engines and the motors used as electric generators supplying current for general use around the mine and mill or for driving other compressors.

Power Costs

The Hydro-Electric Power Commission of Ontario, created by statute in May, 1906, contracted with the Ontario Power Company for 100,000 horse power generated at Niagara Falls at a minimum price of $9.00 per horse power per annum. In 1908 the first contract was entered into by the Commission with twelve municipalities to supply 25,135 horse power at prices based upon the estimated cost of service, ranging from $18.10 to $29.50 per horse power. At the present time prices for power supplied by the Commission range from $15 to $40 per horse power per annum, depending on the uses, size of the block of power, the distance transmitted, etc. Schedules of rates for different municipalities are given in the annual reports of the Commission.

For purposes of comparison it is interesting to note that the Government of Tasmania is developing the Great Lake water power, and expects to be able to furnish 40,000 electrical horse power before March, 1917, at the following rates:

1,000 to 2,000 at £4 per horse power per annum
10,000 and over at £2 " " " " "

Proportionate rates are quoted for intermediate blocks of power.

In the Cobalt silver camp where the Northern Ontario Light and Power Company operates, and also at Porcupine, where the Northern Canada Power Company supplies electric energy, a flat rate of $50 per horse power per annum has obtained until recently. Many of the contracts are expiring and the power companies are proposing to introduce new schedules with a sliding scale of rates depending on the amount of power consumed and the load factor. In some cases the new rates work out at a higher figure than the old. The largest consumer in the Cobalt camp is the Dominion Reduction Company, which requires over 500 horse power for operating its plant. The Dome and Hollinger mines are the largest consumers in the Porcupine camp. At the present time the former uses about 2,000 and the latter 3,500 electrical horse power.

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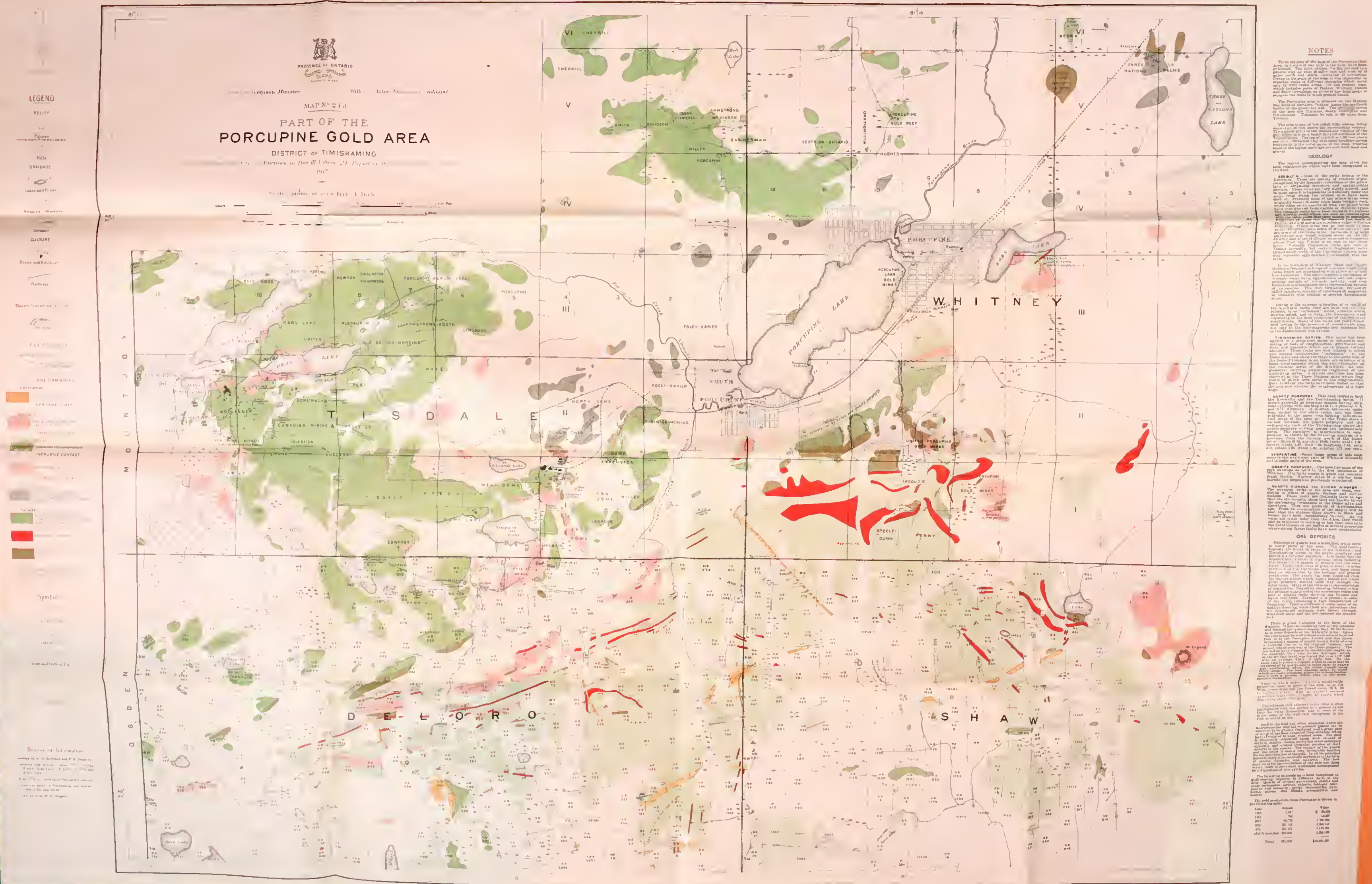
PROVINCE OF ONTARIO
MAP No 21a
PART OF THE
PORCUPINE GOLD AREA
DISTRICT OF TIMISKAMING
LEGEND
CULTURE
NOTES
GEOLOGY
ORE DEPOSITS
TISDALE
WHITNEY
DELORO
SHAW
MOUNTJOY
OGDEN
PORCUPINE LAKE
PORCUPINE
SOUTH PORCUPINE
NORTH DOME
WEST DOME
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PLENAURUM
JUPITER
CANADIAN MINING & FINANCE CO
McENANEY
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Symbols


PROVINCE OF ONTARIO
MAP No 21
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DISTRICT OF TIMISKAMING
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PRE-CAMBRIAN
PORCUPINE
GOLD RIDGE
BEWICK MOREING
NEWTON
SHILLINGTON-RICHARDSON
PORCUPINE-AURUM (REA)
Con. III
GILLIES LAKE
PEARL LAKE
PLENAURUM
ARMSTRONG BOOTH
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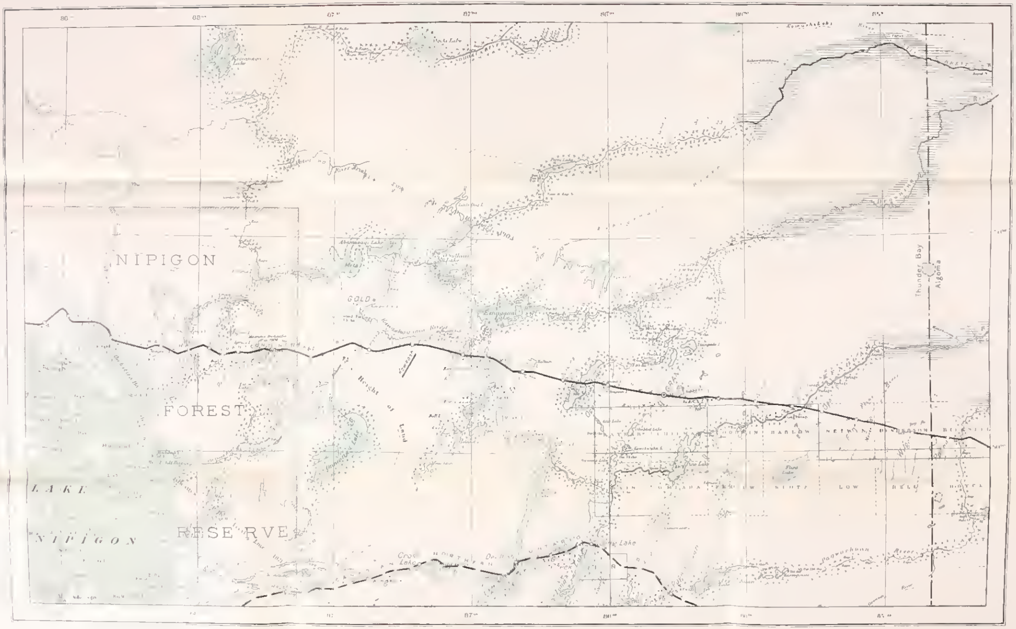
JUPITER
BEWICK MOREING
PEARL LAKE
TIMMINS
FLINN
MAPES
SCHUMACHER
PLATT
Con. II
NORTH DOME
HOLLINGER
SCHUMACHER
BEWICK-MOREING
VIPOND
SUCCESS
WEST DOME
DOME
TISDALE
Con. I
EAST DOME
SIMPSON LAKE
BRYDGE
EAST DOME
MARTIN
STANDARD PORCUPINE
MOUNTJOY
WHITNEY
DEL ORO

Hon. G. H. Ferguson, Minister   Willet G. Miller, Provincial

GEOLOGICAL NOTES



LEGEND

Paleozoic

Keweenawan

Laurentian

Keewatin

SOURCES OF INFORMATION

Topography

Geology

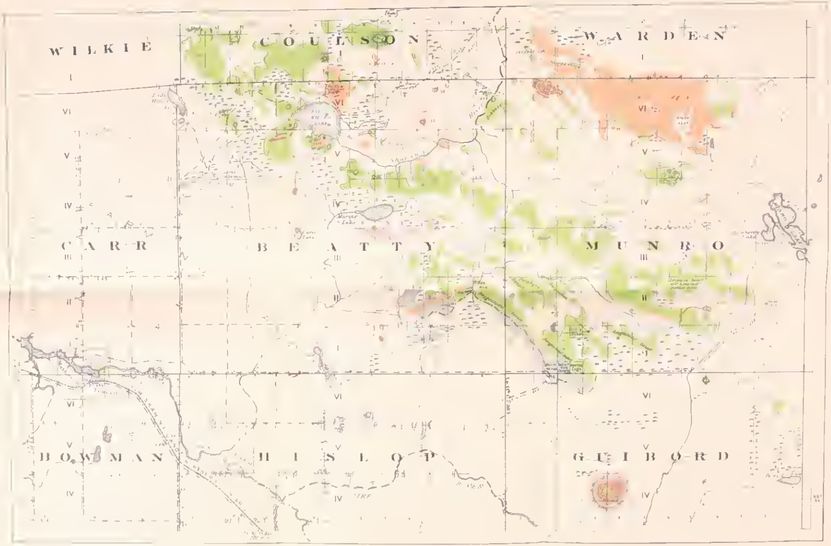
MAP No. 24c.

PART OF THUNDER BAY DISTRICT
showing the

KOWKASH GOLD AREA

To accompany Part I, Volume 24, Report of Bureau of Mines, 1915

Scale = 7.89 Miles to 1 Inch



LEGEND

Glacial and Recent

Stratified clay and sand, boulder clay

PRE-CAMBRIAN

Post Timiskaming Intrusives

Timiskaming Series

Keewatin

Intrusives

SIGNS

NOTES

Geology

Character of the Gold Veins

MAP No. 24 B

BEATTY – MUNRO GOLD AREA

DISTRICT of TIMISKAMING

J. D. Hopkins in Part I, Volume 24, Report of Bureau of Mines

1915